A Buyer's Guide To Modems

COMPUTE!'s GAZETTE

$3.00
January 1987
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02220 $4.25 Canada

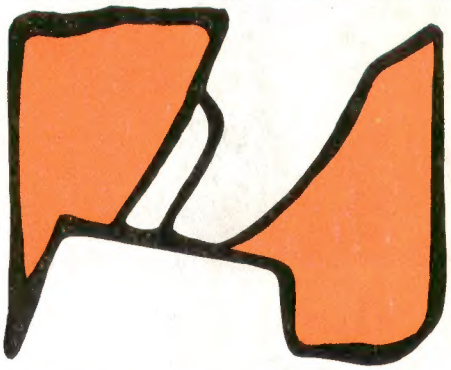
FOR **COMMODORE** PERSONAL COMPUTER USERS

The Fundamentals of Downloading

A step-by-step guide to accessing software via telecomputing

Connect 'Em

The classic pencil-and-paper game takes on a new twist in this computer version. For the 128, 64, Plus/4, and 16.

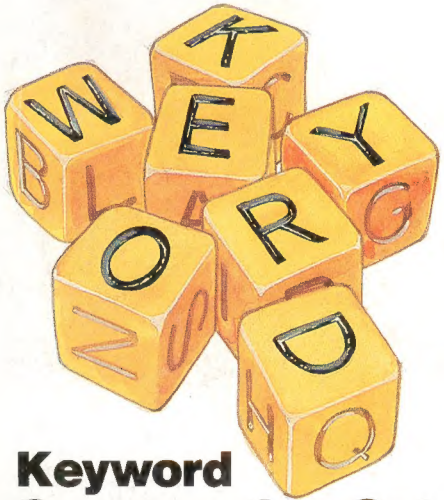


One-Touch Function Keys

Disk directories, LIST, SAVE, or LOAD with a single keypress. For the 64.

Also In This Issue:

- Medium-Resolution Graphics For The 64
- Icon Changer For *GEOS*
- CP/M: Surviving With 40 Columns
- Software Reviews
- And More



Keyword Construction Set

WRITE instead of PRINT? NUEVO for NEW? Easily change any BASIC keywords with this clever program for the 64.

Decipede

Stay calm and shoot fast to defend yourself from a frantic insect invasion in this arcade-style action game for the Commodore 64.

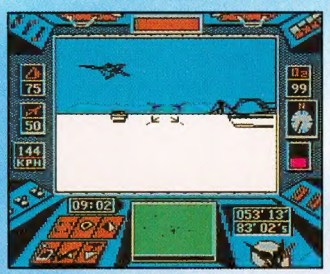
0 71486 02220 6 01

(Not Bad for a 37-Ton Tank.)

0 to 100 MPH In 4 Seconds

In Antarctica, no one can hear you scream . . .

You're caught in a blizzard with your air supply running low. Snowblind, you hear a scream overhead and it isn't the wind. An alien fighter plane has spotted you and he's got you locked-on. If he's got buddies, you could end up Spam®-in-a-can. Uh-oh, your radar picks up incoming fighters, tanks, missiles and rockets. Get ready for the fight of your life . . .



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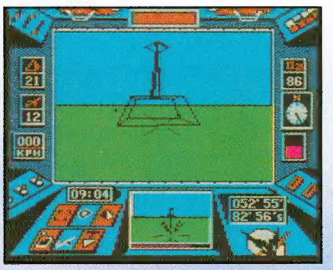
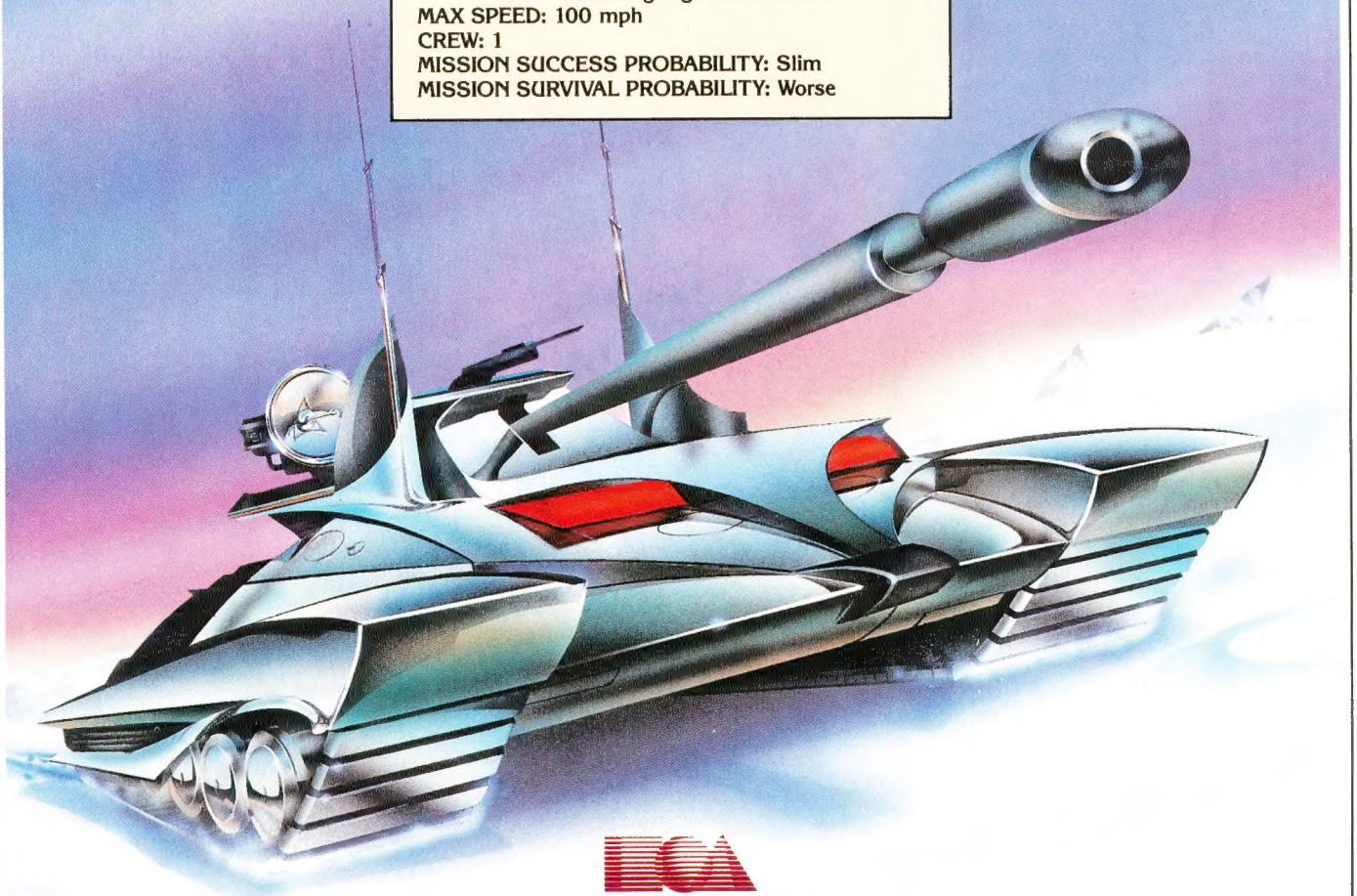
MISSION SURVIVAL PROBABILITY: Worse



The Main Fortress. If you're good enough to find it, are you bad enough to destroy it?



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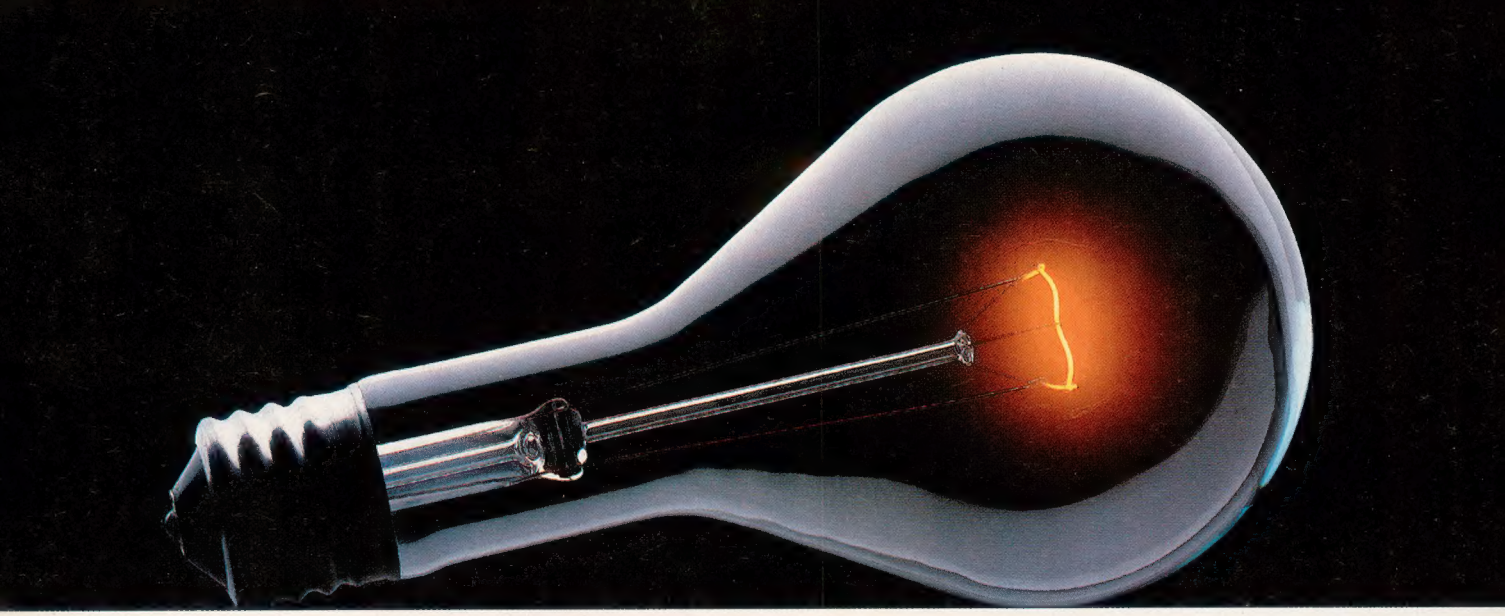

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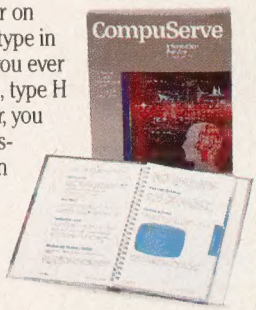

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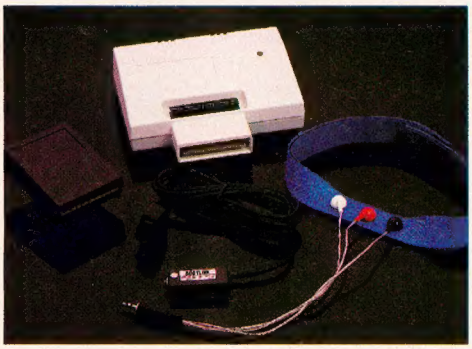

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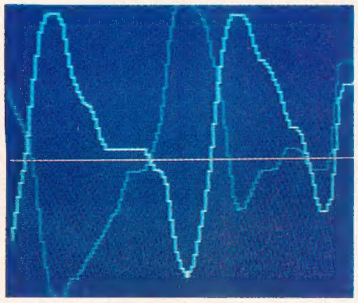

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editor's notes

As you read this, we're preparing to make our annual trek to that greatest of trade shows, the Winter Consumer Electronics Show, held in Las Vegas, Nevada, in early January each year. At the risk of seeming ungrateful, we've always wondered why anyone would spend the latter portion of the first week in January in the middle of the Nevada desert, but we make the journey, year after year, finding very little element of choice in the matter.

Imagine a group of interconnected enclosed football stadiums, and you can only begin to visualize the inside of a Consumer Electronics Show. In the course of less than a week, over 100,000 electronics-industry representatives, buyers, sellers, watchers, manufacturers, etc., will whisk through the hundreds and hundreds of exhibits, making buy and sell decisions that most of us won't see on store shelves for months, if ever. As we have those among us here who exhibit the decided traits of high-tech groupies, we invariably fall madly in need of one of those and two of those and...you get the picture.

Imagine seeing a quite exceptional digital television exhibiting multiple screens, incredible clarity, and amazing fidelity, and discovering that no mortals will be able to obtain one until maybe next November. Or imagine running across that product that's just exactly what you've been looking for and discovering (three months later) that its reception at the Consumer Electronics Show earned it a place on the list of products that were cancelled due to lack of interest. The same phenomenon that cancels our favorite television shows now manages to follow our product choices around. These digressions aside, we're really there to follow the pendings and happenings of our own special end of the industry, and the occasion of the fifth anniversary year of the Commodore 64 seems a good time to look back, and ahead.

We attended our first Winter Consumer Electronics Show in January 1980. There we introduced our then-new magazine, COMPUTE!. Commodore was an exhibitor at that show, with quite a large booth exhibiting their product mainstream: watches. In the very back corner of their booth, relegated to a lesser positioning so as not to interfere with the real business of the company, was a display of a couple of Commodore computers.

We were a very timid industry then, and there was very little in the way of activity for computer watchers at that show. Off in a separate hall, a company called Automated Simulations was demonstrating some of its software—it's the only software vendor we recall seeing then. Automated Simulations, for those of you who don't recall, is now Epyx. The intervening years have brought us great looming booths and displays from Commodore and Atari. We've also seen quite a bit of coming on strong and going away quietly: the massive personal computing extravaganzas of Texas Instruments, and Sinclair, and Acorn, and Ohio Scientific, and many, many others.

Now a great deal of the personal computing show activity has slowed. Some have moved to COMDEX, a computer-dealer/industry trade show that occurs in the fall. Some have simply opted for alternative avenues to visibility. CES is a trendy show, in part. In the midst of what one perceives as a great deal of stability among the present giants of the industry—the Sonys, the GEs, etc., one is aware of massive consumer trends moving through and around the exhibit halls. The excitement is quite real, and you can't help but be aware of the magnitude of moment in watching the first compact-disk read-only drive talk to an Atari, or be fascinated by the convergence of various product lines into an evolutionary marriage of electronic home products. So each year, while we're warming up for this, wondering why anyone would go spend a week in the Nevada desert during early January, we begin to get just a tiny bit excited, and wonder what we'll see this time.

Robert C. Lock
Editor in Chief

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Colonel Jack Rosenow, President of ActionSoft Corporation, is out to turn the simulation software industry upside down:

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Colonel Jack Rosenow, USAF (Ret)

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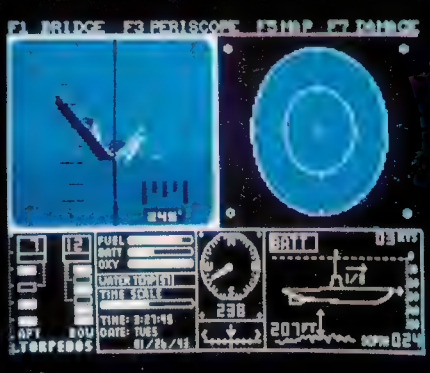

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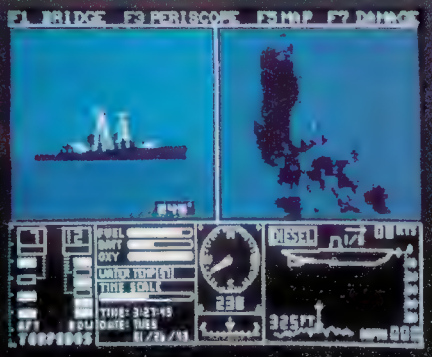

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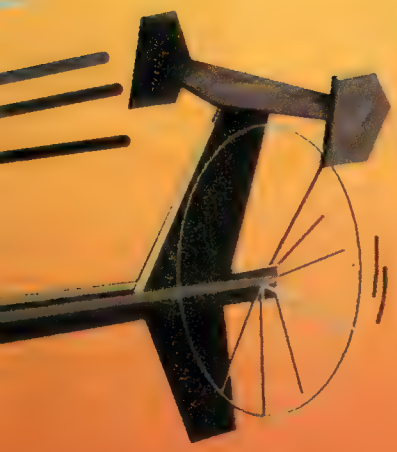

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Do you have a question or a problem? Have you discovered something that could help other Commodore users? We want to hear from you. Write to Gazette Feedback, COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403. We regret that due to the volume of mail received, we cannot respond individually to programming questions.

Magnets, Peripherals, And Smeared Ink

We've had our two 64s (one for us and one for the kids) for almost three years, and use them daily. Recently we were told the disk drive must be kept on the right side of the computer as there is a magnet in the left side that would erase disks placed in the drive. Is there any truth to this?

Would you also please tell us the correct order for turning on peripherals? We have had several discussions with friends and agreed that you would have the last word.

Also, what would be the cause and correction of the faint black lines running across the paper (as if the ink were smearing) when using certain programs such as *Print Shop* or *Newsroom*? We've adjusted the paper thickness lever and changed ribbons, but the problem persists.

Jan Weis

While it's true that strong magnetic fields can destroy information recorded on disks, you needn't be concerned about which side of the computer the disk drive resides on. There's no significant source of magnetism inside a Commodore 64. In a quick glance around the office, we noticed that many people place their disk drive to the right of the 64, but that's probably because it's easier for right-handed people to use a disk drive if it's on the right. Those who have a disk drive on the left have experienced no problems.

The "which order to turn on peripherals" question has caused quite a bit of discussion in the past few years. Here's the final word: It doesn't matter whether you turn on the computer, printer, or disk drive first. Some Commodore owners swear that turning on the printer first, then the disk drive, makes everything work more smoothly. Others argue that the disk drive should be turned on first. Still others say the computer should be first. If you feel that a specific power-on sequence works best for you, then that's the right one for your equipment.

The black lines in your printouts are caused by overlapping lines. Printers are most often used to print letters and other characters, so they're set to put spaces between lines by feeding the paper forward a little between lines. Within programs like Print Shop *and* Newsroom*, the printouts are high-resolution images. Ideally, each hi-res line would print just below the line above. But this isn't always possible, so printer manufacturers have a choice: Either put a smidgen of white space between lines or overlap the lines a bit. Overlapping lines gives the picture a more "solid" look, so it's preferred.*

The 64C

I'm planning to sell my regular 64 to buy the new Commodore 64C. Is it worth it, or should I keep my regular one?

Scott Cummins

The new computer differs from the old only cosmetically; internally, the 64C is exactly the same as the older 64. The 64C does come with new software—the GEOS *operating system and software for the QuantumLink telecomputing service, but you can buy this software separately and run it on your regular 64. You may prefer the enhanced packaging of the 64C; or you may prefer to purchase the software and "upgrade" the computer yourself.*

OUT OF DATA

When I put the cursor on the line that says "READY." and press RETURN, the computer prints an OUT OF DATA error message. Is READY a command?

Rehan Ahmed

READY isn't a command, but READ is. READ takes information from DATA statements for use within a program. When you press RETURN over READY, you're telling the computer to read data into the variable Y. If there are no DATA statements in the program in memory, there's nothing to read and that's why you see the OUT OF DATA error.

To see how this works, type NEW; then enter a line such as 10 DATA 500. Press RUN/STOP–RESTORE (to get the READY prompt). Cursor up to READY, press RETURN, and then type PRINT Y. The READ has put the number 500 into the variable Y, and PRINT Y prints out the number.

The Mystery Of The Two Missing Bytes

When the 64 is turned on, it says 38911 bytes free. But if I type PRINT FRE(0) + 2↑16 in immediate mode, it prints the number 38909. Now I don't care about the two bytes, but is that normal or should it be 38911?

Stephen J. Sommer

On power-up, the 64 tests the beginning and end of free memory and subtracts to find out how much memory is available. There are 38911 bytes free for use by BASIC.

A BASIC program line always ends with a zero, and the last line in a program contains three zeros—one for the end of the line, plus two more zeros that indicate the end of the program. When you turn on your 64, there's no BASIC program in memory and the memory test finds 38911 bytes free. But the initialization of BASIC, which comes later in the power-on sequence, places two zeros at the start of the BASIC program text area (at 2049 and 2050), just in case you try to LIST or RUN with no program entered.

So, even though there's no program, two bytes are used. When you use the FRE function to print the amount of free memory, you see 38909 instead of 38911.

CP/M Listings

All of your programs are written for BASIC or MLX-format machine language. Is there any possibility you'll print programs for the CP/M mode of the 128?

Hubert Lin

The Commodore 64 and 128 have a built-in operating system and a built-in BASIC language. Readers can type in BASIC programs as is, with no other software or hardware (although a disk drive is necessary if you want to save the program).

CP/M is an operating system which can run various languages such as BASIC, C, Turbo Pascal, and so on. But 128 owners don't get a language with the CP/M

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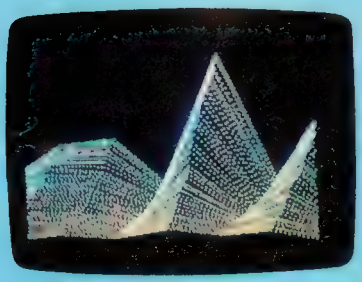

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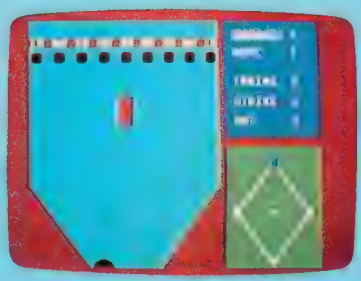

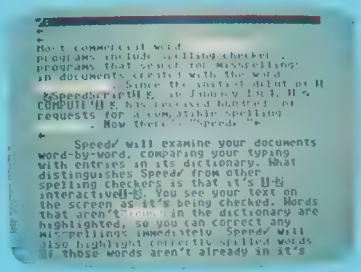

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disk; they have to buy their own. Prices for CP/M languages range from $50 to $200 or more.

All owners of the 128 have CP/M, but only a small percentage own a given language. A type-in program for CP/M mode would appeal only to a small group of 128 owners who happened to own a particular language. We do, however, publish articles for 128 owners who use CP/M. For example, see page 97 of this issue.

Secret Codes

I've been trying to write a program that would both encode and decode a message. The code works by taking the first two letters of a word, checking the number on the enclosed grid, and writing down that number. For example, "THIS IS MY CODE" would turn into 348-365 365 505 113-149, because the number at column T, row H, is 348, the number for I and S is 365, and so on.

My question is, how do you break a word down two letters at a time and then turn it into a number? If you have any ideas, I'd appreciate them.

Robb Feldhege

The MID$ function, which extracts a substring from a larger string, would serve your purposes. It's followed by parentheses containing a string and two numbers, separated by commas. The first number is the starting position within the larger string. The second is how many characters you wish to extract.

For example, A$ = "SECRETLY": PRINT MID$(A$,5,2) would start at the fifth letter, take two characters, and print ET. If the second number is one, you can look at characters one at a time.

Another useful function is LEN, which returns the length of a string. PRINT LEN("THIS IS A TEST") would print the number 14. The following program asks you to input a word and then prints out the characters one by one, using LEN and MID$:

```
10 PRINT "INPUT A WORD (OR END)"
20 INPUT W$: IF W$ = "END" THEN
   STOP
30 A = LEN(W$)
40 FOR J = 1 TO A: X$ = MID$(W$,J,1)
50 PRINT "LETTER #";J;"IS ";X$
60 NEXT: GOTO 10
```

Now that you can pull out individual letters, you need a way to convert them to numbers. The ASC function takes a letter as input and returns the ASCII value. The ASCII numbers 65–90 represent the letters A–Z. PRINT ASC("C"), for example, should return a 67. If you subtract 64, you'll end up with a number from 1–26, assuming the string contains letters but no numbers, spaces, or punctuation marks.

Given two numbers that represent characters (2 and 5 for the letters B and E, for example), you could encode the message with a two-dimensional array. Within the sample grid you sent, the intersection of B and E contains the number 55, so you would have to create an array with the DIM statement—DIM T(26,26)—and then assign a unique number to each slot. T(2,5) would hold a 55, T(9,19) a 365, and so on. Since there are 676 combinations (26 times 26), you should either put the numbers in DATA statements and then READ them into the array or write the numbers to a disk file and then INPUT# them into memory. To decode the numbers into letters, use a one-dimensional string array (DIM F$(676)), each element of which contains a two-letter string.

Avoiding The Save-With-Replace Bug

I have read that it is wise to avoid save-with-replace. My problem is commercial software that uses save-with-replace. I have already lost one file, and I'm afraid it will happen again. Can you give advice on how to use such software?

Ørnulf Nyberg

One solution is to use a different filename with each save and then delete the old files manually from BASIC. Unfortunately, some software uses the name that you loaded the file with to save it back. If your

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*software lets you specify the drive number, your files will be safe. For example, when the program asks for the filename, type 0:*filename *instead of just* filename. *If none of these options is available, turn your disk drive off and then on before saving a file. This is inconvenient, but it will prevent the problems caused occasionally by save-with-replace.*

Deleting A Record From A Relative File

Commodore-indexed relative files fascinate me. Unfortunately, there appears to be relatively little known about how to delete a record from an indexed file. The articles you've published about relative files didn't address this question. I'm sure there are other programmers who would like to know more about the topic.

Larry E. Rich

Here's a brief overview of Commodore's various file implementations.

Imagine a small business that has four customers: Young, Abel, Norton, and Delaney. To save those names to a sequential file, a program has to open the file for writing, write the four names, and then close the file. The names are stored in the order in which they're written, so if Young were the first name in the file, it would be the first one to appear when you opened the file for reading.

A potential problem derives from the sequential nature of such files. If the business grows to the point where there are 5000 customers, it will take a long time to find, say, the 4182nd name. You'd have to read sequentially through 4181 records before you reached the one you wanted, a very slow process. You could give each customer a separate sequential file, but Commodore disks allow a maximum of only 144 files in the directory.

Another limitation occurs when you need to sort the file. To alphabetize, you could read the four names into memory, alphabetize them, scratch the old file, and write a new file. That's fine for small amounts of data, but when there are several thousand records, time becomes a factor.

Relative files to the rescue. If you know where a certain record is, you can read it directly from a relative file without having to search through the intervening records. To find the name at position 3284, you'd set the pointer to 3284 and read the name (or other data) in the record.

To alphabetize a relative file, you could read all the records into memory, sort them, and write them all back out. But that would be just as slow as rewriting a sequential file. A faster way to handle the information is to use a separate index file. (Such indices are usually stored as ordinary sequential files.)

If the files have been written in the order (1) Young, (2) Abel, (3) Norton, and (4) Delaney, the index file would contain the numbers 2, 4, 3, 1, 0, because Abel is record 2, but should be first in the alphabetical list. Delaney (record 4) is next on the sorted list, and so on. The 0 is used to mark the end of the list. Instead of a 0, you could also set another variable to keep track of how many records there are.

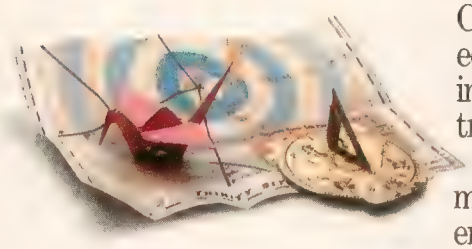
If a new record is added, it goes in the next available position in the relative file. Let's say you add record (5) Michaels. The new index file would contain the numbers 2, 4, 5, 3, 1, and 0. The number 5 has been inserted in the third spot on the list. Note that you don't have to resort the entire list; all you need do is find out where the new record belongs.

Now let's say Delaney's name—record 4—needs to be removed from the list. The first thing you do is change the index file to 2, 5, 3, 1, 0. If the record number isn't on the list, it has been deleted. You might also want to add the number 4 to a list of available records. The next time you add a new customer, don't put the name in record 6; put it in record 4.

The Dangers Of Static

After upgrading from a 64 to a 128 and after using it for over a year, a problem has developed. The fire button on port 2 does not work anymore. There is nothing wrong with the joystick; it

es. One really smells.



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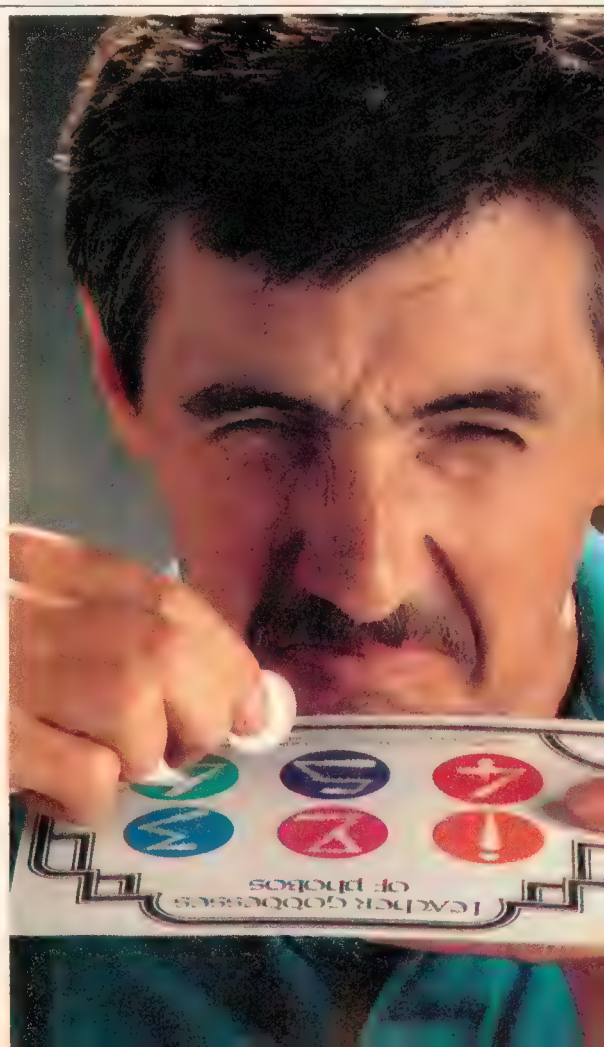

works fine on port 1. There seems to be no problem with the connections inside the computer.

I would be grateful if you could let me know what the problem is and how to fix it myself, since there is not a Commodore dealer in my country.

Yousef E. Ebrahim

It's likely that one of your Complex Interface Adapter (CIA) chips has failed. The probable cause is static electricity. The power switch is very near the joystick ports, so, for example, if you walk across a carpet (building up a static charge) and reach to turn on the computer, your finger may spark against the joystick port and send an unhealthy voltage directly to the CIA chip.

The symptoms may include a joystick port that doesn't work correctly, as you've experienced, or even a totally nonfunctional keyboard. Often you'll find that a number of keys on the keyboard will not work correctly. If you encounter any of these symptons, you're in good company; our experience indicates that this is one of the most common hardware problems for the Commodore 64 and 128.

The solution is to replace the faulty CIA chip, which is either quite simple or nearly impossible, depending on the version of your computer. The CIA to be replaced is the one nearest the keyboard connector. In Commodore 64s this is in the upper-left corner of the circuit board; in 128s it's in the lower right corner. The chip has the numerical designation 6526. If the chip is in a socket, make sure the machine is unplugged from the electrical outlet and just pull out the old one and insert a new one, taking care that the you don't bend any pins and that the new chip is oriented in the same direction as the old one. On some Commodore 64s, the chip may be soldered directly onto the circuit board rather than being in a socket. In this case, we recommend not trying to replace the chip. Unless you have special equipment, it's extremely difficult to remove a large soldered chip without damaging the circuit board. In this case, you'll need to contact a Commodore dealer or repair center about getting a replacement circuit board.

Check the advertisements in GAZETTE *for companies that sell replacement chips.*

Killing SID With Kindness?

After about one year's intensive use, the SID (Sound Interface Device) chip in my Commodore 64 has fallen completely silent. Can this be caused by misusing the chip? For instance, can you damage the chip by POKEing it too frequently?

Teuvo Laitinen

The SID chip is designed to be POKEd; such activity is considered normal use and will not damage it at all. In general, nothing any program does will ever damage any of a computer's internal hardware. Like all other electronic components, SID chips occasionally fail. The only cure is to replace the chip. The answer above about replacing CIA chips also applies to SID chips—replacing the chip will be either simple or impossible, depending on whether or not the one in your computer is socketed. The SID chip, which has the numerical designation 6581, is located near the center of the circuit board in both the 64 and 128.

Appending ML Programs

How is it that there are some BASIC programs that are only three or four lines long and yet they take 30 seconds or more to load? They must be loading a machine language program as well. But there's no LOAD command for this in the BASIC program, and after you run it, it doesn't access the disk.

Somehow the program is automatically loading the ML, because the three or four lines couldn't be so many blocks long on disk. How would I write this type of loader?

Chris Miller

SpeedScript *is a good example of a machine language program that you load and run as if it were a BASIC program. There's no need to type the SYS command because it's built into the program. If you list it, you'll see a single line that says 10 SYS 2061 and no more. And yet, it takes up 20–30 blocks on the disk.*

If you were to load SpeedScript *into an ML monitor and look at locations $0801–$080C, the beginning of BASIC, you'd see the following sequence of bytes:*

```
0B 08 0A 00 9E 32 30 36 31 00 00 00
```

The first two bytes are the line link (a pointer to the next BASIC line, at $080B, which happens to be the second-to-the-last zero). The next two (0A 00) are the line number (10) in low-byte/high-byte format. The token for SYS is $9E, followed by the numbers 2-0-6-1 (as ASCII characters). The three zeros mark the end of a BASIC program.

Location 2061 is the next byte following the zeros, so when you run the program, it executes a SYS to the next available address. The programs you've noticed with three or four lines use the same principle.

SpeedScript *was written with a machine language assembler which wrote the necessary bytes to disk, followed by the ML program. To do this yourself, send the appropriate characters with the .BYTE pseudo-op (if it's available in your assembler). If you're using an ML monitor, store the bytes into memory and then save the memory from $0801 to the end of the ML program. Another way to do this would be to POKE to locations 45–46 (the end of BASIC on the 64) and then use the SAVE command.*

An Undocumented 128 Command

I was experimenting with different functions on the 128 and typed RREGISTER A,B,C,D. The computer accepted it, so I typed PRINT A,B,C,D. Four values appeared and I wrote them down. Later that day, I entered the machine language monitor and was surprised to notice that the values in the accumulator, X register, Y register, and status register (AC, XR, YR, and SR) were the same as the values I had written down! I believe this is a previously undocumented function, since it doesn't appear in the *System Guide*.

Scott K. Silverman

The RREG command in BASIC 7.0 is indeed undocumented, at least within Commodore's manuals. It's not mentioned in either the System Guide *or the* Programmer's Reference Guide. *However, RREG is covered in* COMPUTE!'s 128 Programmer's Guide.

RREG is followed by one or more variable names (A, B, C, D are suitable). It puts the values of the accumulator, and X, Y, and processor status (P) registers into the variables. You can thus pass values from an ML program back to a BASIC program via RREG. You can also send values the other direction, by adding up to four variables or values after a SYS statement. SYS 3072,A1,A2,15,Z(5), for example, would put the value in A1 into the accumulator, A2 into the X register, 15 into the Y register, and Z(5) into the processor status register. The equivalent on the 64 is POKEing values into locations 780–783 before you SYS and then PEEKing locations 780–783 after the RTS from the machine language subroutine.

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Getting Started With Telecommunications Services

Kathy Yakal, Assistant Features Editor

More and more Commodore owners are discovering the fun and value of computer-to-computer telecommunications. And membership in one or more of the nationwide telecommunications services is among the most popular and entertaining ways to telecompute. Here's a look at how to get started.

The explosion in the consumer electronics industry over the last decade or so has caused many people to rethink their traditional notions of entertainment and communication. Take video cassette recorders (VCRs), for example. They are now affordable household items that make it possible to rent, or actually own, copies of motion pictures.

Cable television, to a lesser degree, also gives people more control over their entertainment choices. A cable system incorporating 20 or 30 channels offers many times the choices available just a few years ago.

Likewise, personal computers and *modems*, the peripheral devices that enable your computer to communicate with other computers over telephone lines, are bringing about similar changes in communications. Online news and information networks offer a wide variety of services, ranging from financial information to public domain software to online shopping to conversations with people around the world. You no longer have to wait until the stores are open to shop, or keep looking out the door to see if the paper has arrived, or listen to the busy signal after repeatedly dialing a friend's phone number to chat. And if you choose and use the service wisely, it won't break your budget.

What You'll Need

Although the setup you'll need to connect—or *log on*—to a telecommunications service is relatively simple and inexpensive, the hardware and software required on the other end is not. These services are complex businesses, requiring hundreds of thousands of dollars worth of computer and telephone equipment, and large staffs of programmers and customer-support personnel to keep the systems running.

All you'll need is your Commodore computer, monitor or television, disk drive, and modem. Your considerations in buying a modem will likely have to do with how much you want to spend, the variety of features you want, and your plans for future computer-related purchases.

Modems capable of working with Commodore computers range from under $50 to hundreds of dollars. If you anticipate spending a lot of time online, you may want to investigate the special features offered on more expensive modems. And if you think you'll be hanging onto your Commodore for a few years, many of the inexpensive Commodore-specific modems will suit your purposes. But if you plan to buy another computer in the near future, it might be wise to spend a few extra dollars now on a modem you'll be able to use on both. (For more information on modems, see "A Buyer's Guide to Modems" on page 30.)

Telecommunications is similar to other computer applications in that it requires special software. Telecommunications software, often called *terminal software*, does the work necessary to let your computer "talk" to another computer. Most modems come with such programs of their own, but often these are not sophisticated enough to handle much more than the most routine operations. If you find this to be true after spending some time online, you can look into buying something more suitable.

Once you have the hardware and software necessary, you'll need a way to get access to the online services. This is handled in one of three ways. Some services offer starter kits, packets that you can buy at a computer store or through the mail that contain instructions for the system as well as your own personal log-on information. Some require a phone call or a request in writing to receive a *password*—the code word that keeps your telecommunications private. Instructions for using these systems are handled online and also through written documentation. In both of these cases, just about any terminal software will suffice. But at least one online service currently operating—QuantumLink—uses a special terminal program written specifically for Commodore computers, and subscribers must obtain one of these disks.

There's one more thing that's advisable to consider before

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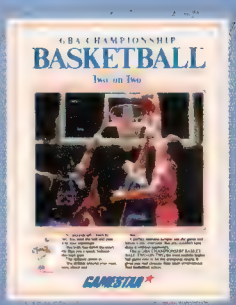

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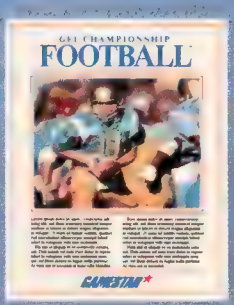

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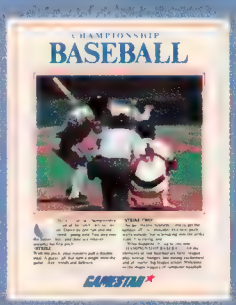

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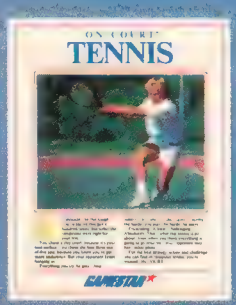

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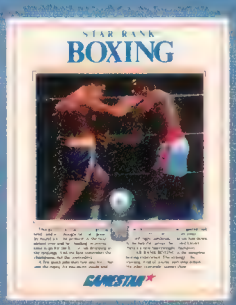

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launching into telecommunications: Where is your computer system physically located? Obviously, it needs to be near a phone. If you have only one phone in your home and would like to add an extension specifically for telecommunications, think about placing it a room away from other family activity. Because hourly online charges are lowest at the least active hours for telephone services (evenings and weekends), you may be spending some time telecommunicating when other occupants of your home are sleeping. If you live with a number of other people who use the phone a lot and your telecommunications needs are extensive, you may even want to think about adding a second line.

How To Choose

Currently, there are about a half-dozen or so telecommunications services operating in the home market that attract a good many Commodore owners.

You may ultimately decide to subscribe to more than one online service, but before you invest in your first one, it's best to look at your needs and budget, as well as how each service can meet those criteria.

First, carefully examine each service's fee schedules and hours of operation. Services available 24 hours every day often charge much higher rates for weekday daytime use than evenings and weekends, since they offer features used by businesses during work hours. This tends to discourage casual users from logging on during those hours, freeing the phone lines and the system itself.

Next, think about your personal needs for communication and information. Each service offers a unique configuration of the following:

• *Social interaction.* Most services offer many different opportunities for interaction with other users. Some have conference areas, where the conversation is general, and the agenda is set by whomever happens to be on at any particular moment. Some services set aside special times and areas for conferences focusing on a single topic. Private conversations with one other person are usually possible, as is electronic mail, messages that you can leave for another user to pick up the next time he or she logs on. And if you get lost in the system at any time, there is usually a command to signal a *system operator* (sysop) that you need some individual assistance.

• *Financial information.* If you're a serious investor in the stock market or even just a casual owner of a few stocks here and there, you may want updates on what's happening on the stock exchanges. Some telecommunications services offer easy access to current stock prices, usually with at least a 15-minute delay.

• *Computer-related information.* Many online services have their roots in this activity, since the impetus for starting them was often to provide a forum for computer owners to share technical information and trade software. Generally, the most technically proficient computer users in this country are very active online, and many are available for formal and informal conferencing on a variety of computer-related topics. Most services offer special-interest groups (SIGs) where information about specific brands of computers is swapped.

Commodore SIGs are generally divided into several different segments: conference forums, where users can just chat; downloading areas, where individuals can download public domain software (see "The Fundamentals of Downloading" on page 34); news and information sections, where the latest Commodore news, industry rumors, and product information can be found; electronic-mail areas, where users can leave open messages for technical help or private messages to other users; and bulletin boards (BBSs), where messages and other information focus on a variety of more specialized issues.

• *Topical SIGs.* The growing number of people online who want to communicate with other people on non-computer-related topics has led many services to open SIGs dealing with a variety of these topics. Just about any interest imaginable can be found on different services, and new ones are constantly being created as needs arise. To make these areas as helpful as possible to their users, system planners often enlist the help of experts in a given field to answer questions and facilitate conferences.

• *News and sports.* The newspaper, radio, and television may still be the preferred way to get the latest news about current events, weather, and sports, but online services continue to improve their coverage. They can't as yet provide the kind of in-depth coverage a newspaper can in the same amount of time, but they have an advantage in that they don't have to wait for printing and delivery time. Their edge lies in fast access to breaking news headlines.

• *Travel services.* In many cases, a travel agent may be faster and cheaper for cutting through to the best fares and schedules, but online airline guides are seeing an increase in sophistication and popularity. Their greatest advantage may lie in emergency situations. More than one harried traveler has passed up the long lines at the ticket counter in the airport, hooked up a portable computer with a built-in modem to a pay phone, and made a last-minute change in flight reservations.

• *Online gaming.* Playing games over the phone lines using computers has gone on for many years, but these games have generally been limited to text commands that can be easily passed from one kind of computer to another. Sophisticated games that incorporate color, graphics, and animation require the kinds of standards that are found only when one kind of computer, like a Commodore, is used to play *telegames* with another Commodore. Still, most services offer a wide variety of single-player and multiplayer games, ranging from computer versions of simple board games to complicated strategy games like CompuServe's *MegaWars*.

• *Public domain software.* This is one of the most popular features of online services and BBSs, and also one of their most technically difficult functions. Thousands of public domain—or noncopyrighted—programs, covering every computer application, are available online. Mastering the ins and outs of downloading is the trick here.

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Linking Up And Getting Around

There are two ways of getting in touch with an online service. Some have phone numbers dedicated to their services in most major cities. However, if you live in a rural area, this may involve a long-distance phone call every time you log on. Other services use networks, such as Tymnet, Uninet, and Datapac. Using dedicated phone lines in major cities, these networks let you link up indirectly to the desired online service. Each service has specialized commands that you enter to gain access to the system once you've called the network number. Usually, this is just a brief pattern of letters, digits, and punctuation marks.

Once you're actually online with a service, getting around to the different areas you want to explore requires some knowledge of the system's menu structure. Most use a *branching menu* system. You enter at the main introductory area, move out to the general topic area you want to pursue, work your way down within that branching system, and then retrace your steps when you want to move to a different area. Most services also offer an *expert mode* that skips most of the menus to save time and money, letting you quickly jump to where you want to be.

Even infrequent users of telecommunications services need to learn a bit about a particular system's *command structure*, the patterns of keys that you press to move around. Knowing your way around will save time and money, and you'll help avoid annoying other users with constant queries for help. Also, you'll prevent an inadvertent lockup, or actual bump off the system. For example, if you press the wrong sequence of keys, you may find that you're running in place, and no keypresses will get you out. You'll have to turn off your computer, reload your terminal software, log on to the system, and get back to where you were. That whole sequence can take several minutes, and leave an unnecessary bad taste in your mouth for telecommunications in general. Such a scenario can be avoided from the start with a little preparation.

What's Online For Commodore?

All of the major online telecommunications systems offer special Commodore-specific features, though Commodore owners may find many general areas of interest there, too. Here's a look at fees, subscriber information, and a brief overview of what's available for Commodore owners on several of the leading online services.

American People/Link

The Commodore Club here continues to be one of the most popular areas of the service, offering conversation, special forums, and public domain software for downloading. Many Commodore *Plinkers* (People *Linkers*) frequent the general interest areas as well. A Help system is available for beginners, as is Advanced Mode for more experienced users.

American Home Network, 3215 N. Frontage Rd., Suite 1505, Arlington Heights, IL 60004; 800-524-0100 (Illinois residents call 312-870-5200); non-prime-time access rate is $4.25 per hour at 300 baud and $4.95 an

hour at 1200 baud; prime-time fees are $11.95 for 300 baud and $12.65 for 1200 baud (Illinois residents pay $4.25 at all times).

CompuServe Information Service

CompuServe was one of the earliest online gathering places for Commodore owners, and many still congregate there. One of the main draws for this service lies in sheer numbers; close to 300,000 people are subscribers. A subscriber base of this size allows a service to offer a great variety of general interest features, though specific needs for Commodore owners are also readily available.

CompuServe, P.O. Box 20212, Columbus, OH 43220; 800-848-8199; $39.95 registration fee; prime-time access is $12.50 an hour at 300 baud and $15 an hour at 1200 baud, with non-prime-time rates of $6 an hour at 300 baud and $12.50 an hour at 1200 baud.

Delphi

Delphi has developed a steady following over its few years of existence, many of whom are some of the most familiar names in Commodore computing. Flagship Commodore and Starship Amiga, the two Commodore SIGs, offer interaction and assistance to Commodore owners.

Delphi, 3 Blackstone Ct., Cambridge, MA 02139; 800-544-4005; $49.95 registration fee; prime-time access is $17.40 an hour and non-prime-time access is $7.20 an hour.

GEnie

Only in its second year of operation, this service of General Electric has already drawn close to 30,000 subscribers, many of whom are Commodore owners. Similar in menu structure to CompuServe, its Commodore SIG offers many of the main features found on older, more established services.

General Electric Information Services, 401 N. Washington St., Rockville, MD 20850; 800-638-9636, ext. 21; $18 registration fee; prime-time access is $35 an hour, and non-prime-time access is $5 an hour.

QuantumLink

Designed specifically for Commodore owners, this service requires special software, provided by QuantumLink, for access. This software makes color and graphics possible, allowing easy-to-follow menus controlled by the functions keys, and interactive, animated online gaming. Commodore provides technical and marketing support for QuantumLink.

QuantumLink Customer Service, 8620 Westwood Center Dr., Vienna, VA 22180; 800-392-8200; no registration fee; $9.95 monthly charge (no additional charges except for certain selected services at six cents a minute).

The Source

Though more business-oriented in the past, the Source has been adding to its consumer-oriented features. SIGs were added about a year ago, among them, one for Commodore.

The Source, 1616 Anderson Rd., McLean, VA 22102; 800-336-3366; $49.95 registration fee. Billing is $10 a month or your usage, whichever is greater. At 300 baud, prime-time access is 36 cents a minute and non-prime-time access is 14 cents a minute; at 1200 baud, prime-time rate is 43 cents a minute and non-prime-time is 18 cents a minute.

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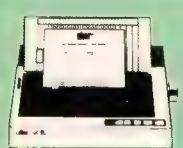

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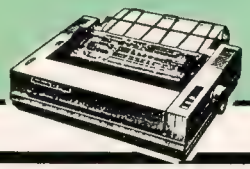

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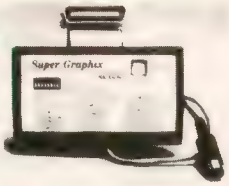

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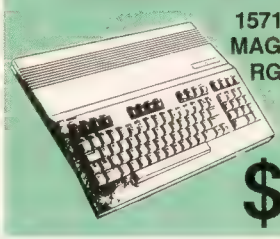

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A Buyer's Guide To Modems

Caroline Hanlon, Editorial Assistant

Telecommunications is one of the fastest growing areas of computer use for Commodore owners. All you need to get started are your computer, a terminal program, and the right modem. Here's a look at the range of inexpensive modems currently on the market.

Online services, bulletin boards, home banking, and a host of other telecommunications opportunities are currently available to Commodore owners. And the list is growing all the time.

Thousands of Commodore computer owners have already added telecommunications to their regular computing activities. If you're interested in getting started, or simply want to buy a different modem from the one you have, the following chart should answer most of your questions. We've kept our list to those modems that cost under $300. But for many Commodore owners, a satisfactory modem can be purchased for less than half that price. The higher the price of the modem, the more capabilities you'll get. Features such as auto-answer and auto-originate can give you flexibility and speed, especially important if you're online extensively.

For those unfamiliar with computer telecommunications, a modem (MOdulator-DEModulator) is simply a device that translates your computer's digital data into analog, or continuous-tone, transmissions carried by telephone lines. The computer at the other end of the telephone line uses its modem to alter the transmission back to digital form.

We've listed the most important features you should consider. Here's a brief explanation of some of the categories:

• **Compatibility**—Commodore 64- and 128-compatible modems usually connect directly to the computer through the user port; RS-232 modems require an interface adapter since Commodore computers don't have a standard RS-232 port.

• **Baud Rate**—The speed at which bits of data are transmitted. The bulk of the low-cost modems carry data at 300 baud, although an increasing number of modems are capable of faster 1200 bits per second speed.

• **Duplexing**—Modems communicate at half-duplex (one computer sending or receiving at a time) or full-duplex (both computers sending and receiving at the same time). Most modems are capable of both half and full duplexing.

• **Auto-Answer/Auto-Originate**—Can the modem automatically answer calls and receive information; can it automatically dial telephone numbers and connect your computer to other computers?

• **Self-Test**—A modem's ability to check itself to determine if everything is working, and is connected correctly.

• **Carrier Detection Indicator**—A light—usually a light-emitting diode (LED)—a sound, or a screen message that indicates that your computer has connected and disconnected with another computer.

• **Terminal Software Included?**—Many modems are sold with a telecommunications program included in the package. If not, you'll need to purchase your own terminal software.

Modem Manufacturers And Distributors

Listed below are the manufacturers and distributors of the modems included in this buyer's guide.

Anchor Automation, Inc., 6913 Valjean Ave., Van Nuys, CA 91406, 818-997-7758

Commodore Business Machines, 1200 Wilson Dr., West Chester, PA 19380, 215-431-9100

Everett/Charles Marketing Serivces, Inc., 6101 Cherry Ave., Fontana, CA 92335, 714–899–2521.

Hayes Microcomputer Products, P.O. Box 105203, Atlanta, GA 30348, 404-441-1617.

Inmac, 130 S. Wolfe Rd., Sunnyvale, CA 94086, 408-727-1970

Intec Corp., 21751 West Nine Mile Rd., Suite 122, Southfield, MI 48075, 313-352-0066

MFJ Enterprises Inc., 921 Louisville Rd., Starkville, MS 39759, 601-323-5869 or 800-647-1800

Mitsuba, (US Distributor: Everett/Charles Marketing Services, Inc.), 6101 Cherry Ave., Fontana, CA 92335, 714-899-2521

Novation, Inc., 20409 Prarie St., Chatsworth, CA 91311, 818-996-5060

Qubié, 507 Calle San Pablo, Camarillo, CA 93010, 805-987-9741

TNW Corp., 950 Hotel Circle North, Suite N, San Diego, CA 92108, 619-296-2115

Tandata Marketing Ltd., Albert Road North, Malvern, Worcs WR14 2TL, England (US Agent: US Telecom Inc., 315 Greenwich Street, New York, NY 10013, 212-608-1419)

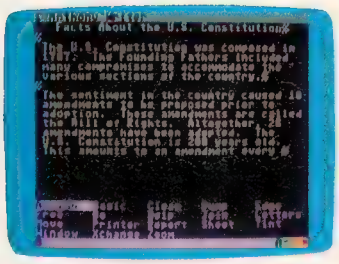
Touchbase Design, 1447 South Crest Dr., Los Angeles, CA 90035, 213-277-1208

US Robotics, Inc., 8100 North McCormick Blvd., Skokie, IL 60076, 312-982-5001 or 1-800-DIAL-USR

Universal Data Systems, 5000 Bradford Dr., Huntsville, AL 35805, 205-721-8000

1-800-FLOPPYS, 22255 Greenfield, Southfield, MI 48075, 800-356-7797

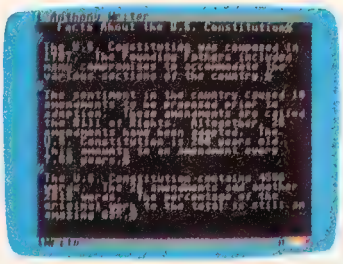
We do windows.



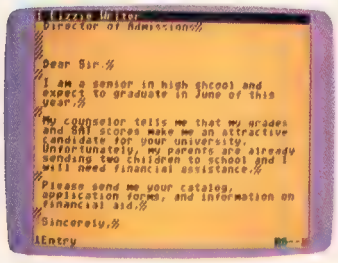
Open a C-MORE window. Whip out C-MORE Writer to start that paper on the U.S. Constitution.

Open a second window. Use C-MORE Calculator to divide Amendments by years and put the result in your report.

Open another calculator window and figure the rate of change for the whole document.



Get rid of the calculators, finish your report and print it.



Load up C-MORE Writer to write those requests for college catalogs.

In a second window, load your C-MORE Keeper file of college addresses. Address and print those letters!

Open a C-MORE Spreadsheet and figure out how many pages you get to read when the colleges write you back.

Put away Keeper and open another Writer window. Write Mom that you have decided to join the Marines.

Open a C-MORE Keeper window. Make a file of your customers' names, addresses, and lawn care preferences.

In three other windows, load the Basic program you wrote to price your services.

Put away Keeper and programs. Open a C-MORE Spreadsheet to estimate your summer cash flow and profits.

You remember to check your messages. Zoom the family message Keeper from background.

Quickly.

C-More, by C-More Products, Inc., is an operating and applications system for the C-64* series which lets you use up to 4 windows at once with up to 8 applications in memory. You can move data from any window into the word processor, using either C-More applications or programs you write in BASIC.

As the windows above indicate, you can use C-More to write a term paper; carry on a letter writing campaign; or, develop a serious business proposal. The only limitation is your imagination.

C-More applications include a word processor, a database, a scientific calculator, a spreadsheet, and comparative buyer.

To order C-More simply call 1-800-628-2828, ext. 790 with a Visa or Mastercard order. Or send $49.95 in check or money order, plus shipping ($4.50 in the U.S./Canada $6.00 in U.S. funds, plus $2.00 in sales tax for Georgia residents) with the enclosed coupon or facsimile. Allow 4-6 weeks for delivery.

Name _____

Address _____

_____

City _____

State _____ Zip _____

C=MORE™

C-More Products, P.O. Box 81548, Chamblee, Georgia 30348

*Commodore 64 is a trademark of Commodore Electronics, Ltd.
TM-C-More and C-More Products are Trademarks of Prism, Inc.

You can manage and view data across four applications, all at the same time – without changing disks. C-More consists of a diskette, a memory expansion cartridge, and an instruction booklet.

- We also include a free disk copy program. So you can save all your data, and "back-up" your files immediately.
- •• C-More is not copy protected. This makes it exceptionally convenient to use.

With C-More, your computer can grow up with you. So order C-More today and start doing more right away. Dealer inquiries are welcome.

Buyer's Guide

Modem	Manufacturer	Compatibility	Interface Required?	Baud Rate	Duplexing	Auto-Answer	Auto-Originate	Self-Test	Carrier Detection Indicator	Power Supply	Cables/ Connectors Included?	Terminal Software Included?	Warranty	Price	Comments
Volks 6420	Anchor Automation, Inc.	64, 128 (in 64 mode)	no	300	full/half	yes	yes	no	screen	host computer	yes	yes	2 years	$ 99	
Volks 6480	Anchor Automation, Inc.	64, 128 (in 128 mode)	no	300/1200	full/half	yes	yes	no	screen	host computer	yes	yes	2 years	199	
1660 Modem	Commodore Business Machines, Inc.	64, 128	no	300	full/half	yes	yes	no		host computer	plugs into computer	yes	90 days	129.95	
1670 Modem	Commodore Business Machines, Inc.	64, 128	no	300/1200	full/half	yes	yes	no		host computer	plugs into computer	yes	90 days	199.95	
Practical Peripherals 1200SA	Everett/Charles Marketing	RS-232	yes	300/1200	full/half	yes	yes	yes	LED	AC	no	no	5 years	239	Hayes compatible
Avatex 1200HC	Everett/Charles Marketing	RS-232	yes	1200	full/half	yes	yes	yes	LED	AC	yes	no	1 year	199	
Avatex 1200	Everett/Charles Marketing	VIC-20, 64, 128	yes	300/1200	full	yes	yes	yes	LED	AC	no	no	1 year	159	
Smartmodem 300	Hayes Microcomputer Products	RS-232	yes	300	full/half	yes	yes	yes	LED	AC	no	no	2 years	199	
Password 212A	Inmac	RS-232	yes	300/1200	full/half	yes	yes	yes	screen	AC	some	no	1 year	299	Part No. 8077
Clear Signal 212A	Inmac	RS-232	yes	1200	full/half	yes	yes	yes	LED	AC	some	no	1 year	289	Part No. 8019
Clear Signal 1200 Baud Modem	Inmac	RS-232	yes	1200	full/half	no	no	no	LED	AC	some	no	1 year	259	Part No. 8064
Smart 300 Baud Modem	Inmac	RS-232	yes	300	full	yes	yes	no	LED	AC	some	no	1 year	229	Part No. 8062
Clear Signal 300 Baud Modem	Inmac	RS-232	yes	300	full	no	no	yes	LED	AC	some	no	1 year	99	Part No. 8127
Intec 1200	Intec Corp.	RS-232	no	300/1200	full/half	yes	yes	no	screen	AC	yes	yes	1 year	99.99	Hayes compatible
MFJ-1237	MFJ Enterprises	VIC-20, 64	no	300	full	no	no	no	LED	host computer	yes	program listing in manual	1 year	49.95	
Super Modem 1200	Mitsuba	RS-232	yes	300/1200	full/half	yes	yes	yes	LED	AC	yes	no	1 year	250	
Cat	Novation, Inc.	RS-232	yes	300	full/half	no	no	yes	LED	AC	yes	no	1 year	169	
D-Cat	Novation, Inc.	RS-232	yes	300	full/half	no	no	yes	LED	AC	yes	no	1 year	199	
J-Cat	Novation, Inc.	RS-232	yes	300	full/half	yes	yes	yes	LED	AC	yes	no	1 year	149	
PC 212A/1200E	Qubié	RS-232	yes	1200	full/half	yes	yes	no	LED	AC	yes	no	1 year	149	
PC 212A/2400E	Qubié	RS-232	yes	2400	full/half	yes	yes	no	LED	AC	yes	no	1 year	299	
Operator 103	TNW Corp.	RS-232	yes	300	full/half	yes	yes	yes	beep	AC	yes	no	90 days	169	
Tm 110	Tandata Marketing, Inc.	VIC-20, 64, 128 (in 64 mode)	yes	300	full	no	yes	no	screen	AC	yes, w/ROM cartridge	yes, w/ROM cartridge	90 days	228	separate ROM cartridge required
Travelcomm 1200	Touchbase Design	RS-232	yes	300/1200	full/half	no	yes	no	LED	battery	no	no	1 year	249	
Worldcomm 1200	Touchbase Design	RS-232	yes	300/1200	full/half	yes	yes	no	LED	battery	no	no	2 years	229	interfaces with Radio Shack acoustic cup set
Connect 1200	US Robotics, Inc.	RS-232	yes	300/1200	full/half	yes	yes	yes	LED	AC	phone cable included	no	2 years	149	
UDS-103JLP	Universal Data Systems	RS-232	yes	300	full	yes	no	no	light	telephone line	phone cable included	no	1 year	165	
UDS-212ALP	Universal Data Systems	RS-232	yes	300/1200	full	yes	no	no	LED	telephone line	phone cable included	no	1 year	195	
2400 Baud Smart Communications System	1-800-FLOPPYS	64, 128	yes	2400	full/half	yes	yes	no	LED & screen	AC	no	no	1 year	150	cables, interface, and QuantumLink software package available for $100
1200 Baud Smart Communications System	1-800-FLOPPYS	64, 128	yes	300/1200	full/half	yes	yes	yes	LED & screen	AC	yes	no	2 year	49	cables, interface, and QuantumLink software package available for $50

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Available for IBM PC/IBM PC Compatibles and Commodore 64/128™ microcomputers.

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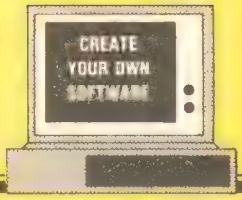
☐ IBM ☐ Commodore 64/128



Ten modules teach you how to write your own programs or modify existing software to fit your needs:

- Getting Started in Programming & Software Design
- Attacking the Problem
- How to Design the Solution and Arrange It Logically
- Coding the Program: High Level Languages
- Coding the Program: Assembly Language
- Testing and Debugging Made Easy
- Creating Meaningful Documentation
- Modifying & Updating Existing Programs
- Tools & Tricks for Program Design
- Writing Advanced Programs

15 Day Trial Examination Order Form

YES! I would like to learn how to make any computer do exactly what I want it to do and would like to examine the first module in the Series absolutely free. If I decide to keep it, I will pay just $24.95 plus $2.25 shipping and handling. I will then receive future modules automatically, one every 4 to 6 weeks. Each of the 10 modules in the Series is $24.95 plus $2.25 shipping and handling and comes on the same 15-day Trial Examination basis. There is no minimum number of modules that I must buy and I may cancel at any time simply by notifying you.

If I do not choose to keep the first module, I will return all materials in good condition and pay nothing. Future modules will be canceled and I will be under no further obligation.

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Make Any Computer Do Exactly What You Want With McGraw-Hill's

Contemporary Programming & Software Design Series

From Writing Your Own Programs to Modifying Existing Software, Here's the New, Easy, and Low Cost Way to Unlock the Secrets of Your Computer

Whether you use computers for business, for personal applications, or for fun, off-the-shelf programs will never do everything you want them to do for you. That's because they were written by programmers to satisfy what they perceived as the needs of the greatest number of potential users—often missing some or many of your specific needs.

That's why McGraw-Hill's new Contemporary Programming and Software Design Series teaches you how to create your own software . . . either from scratch or by making key modifications to existing programs.

There is nothing magical about it. You learn the process of building a computer program step-by-step with McGraw-Hill *Concept Modules* sent to you one at a time, once a month. Each of the ten modules in the Series takes you through an important step in the development of the structure and detailed logic of a program, including testing, debugging, and documentation.

Unique Interactive Hands-On Instruction

Each module includes an easy-to-understand guide PLUS a 5¼" floppy disk containing typical programs and interactive instruction that you can run on Commodore 64 and 128 computers, IBM PCs and PC compatibles for hands-on experience.

In the first Module, for example, when your sample program (Declining Interest Loans) appears on your screen, you'll find errors on certain program lines. You'll also see that the program is only three-quarters completed.

Now comes the fun part. You'll discover how this program is built, and in the process you'll learn how to identify and correct errors. And by the end of Module 1, you'll actually have completed this program yourself.

But there's more. Special graphics on your screen work in conjunction with the accompanying guide to amplify, illustrate, and deepen your understanding of software design principles.

Make no mistake. Almost all books and courses on "programming" teach you only the final 5% of the total programming process—namely, how to code in a specific language . . . information of little value if you don't know how to reach the point in the programming process when you are ready to code.

With the Series, however, you'll learn to create your own programs from scratch, even modify off-the-shelf programs. You'll learn enough BASIC and machine language to get you started on the remaining 5% of the programming process.

Build Your Own Personal Software Library

The sample programs you work with throughout the Series are excellent learning tools. But they're more than that. By combining the sample programs onto one master disk, you'll have the start of your own personal software library. In addition to the programs you've written and modified throughout the Series, you'll also receive dozens of the most popular public domain and user-supported programs, such as data base manager, word processor, calendar generator, appointments reminder and much, much more.

15-Day No-Risk Trial

To order your first module without risk, send the postage-paid card today. Examine the first module for 15 days and see how the Series will help you make your computer do exactly what you want it to do!

If someone has beaten you to the card, write to us for ordering information about the Contemporary Programming and Software Design Series.

The Crucial 95%—Learn the Foundation of Computer Programming

While the Series includes interactive disks that run on specific computers, everything you learn you can apply to any language or machine. Why is this possible? Because McGraw-Hill knows programming is far more than coding a program into the computer using a specific language. In the real world of computers, 95% of the programming process is carried out using design techniques that are independent of specific language or machine. It is this crucial 95% that you thoroughly understand and master in the Series.

McGraw-Hill Continuing Education Center
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The Fundamentals Of Downloading

Todd Heimarck, Assistant Editor

Thousands of public domain programs are just a phone call away—if you know how to use a modem to download. Although it's not especially difficult to download a program, it's easy for newcomers to be mystified by all the new terminology. Here's a step-by-step introduction to downloading—what it is and how it works.

Free Software? What's The Catch?

Well, it's not entirely free. You need a modem, which may cost as little as $20 or as much as $200. You also need a terminal program, although most modems come with terminal software. Finally, you have to find a bulletin board system (BBS) or telecommunications service that has free software available for downloading.

Downloading would be simple if everyone agreed on a single protocol (a systematic transmission scheme). Standards have indeed been set—several times— but there is no single standard on which you can depend.

The Seven-Bit ASCII Standard

A modem has two jobs: sending whistling tones over the phone lines and receiving whistles made by the other computer. When you communicate at 300 *baud*—bits per second—there are two different whistles. Think of the two sounds as high and low, true and false, or one and zero. Each tone can represent a bit of memory. A series of eight tones (plus a starting and ending tone) defines a character, which means there are ten beeps per character. So 300 baud translates to about 30 characters per second, or about 1800 characters per minute when a 300-baud modem is communicating at top speed.

The simplest terminal program does two things over and over. First it checks the keyboard to see if a key has been pressed. If not, it checks the modem to see if a character has arrived. If not, it goes back to the keyboard, then back to the modem, and so on. When the user presses a key, the program sends the appropriate series of eight bits to the modem, which adds a beginning and ending tone and whistles the character into the phone line. When a character comes in, the modem passes the eight bits to the terminal program, which displays the character on the screen.

When you call a friend and type back and forth, this is what happens: You type a character, and the terminal program sends the appropriate bit-pattern to the modem, which whistles into the phone line. The modem at the other end receives the sounds and sends the bits to the terminal program to be translated into a character, which is then printed on the screen. Note that there's no uploading or downloading going on; you and your friend are just typing messages back and forth.

The nearly universal standard for sending text is ASCII, which was invented a few decades ago as a standard way of translating characters into numbers that could be used to communicate between computers and peripherals. ASCII includes 96 printable characters—numbers, punctuation marks, and upper- and lowercase letters. In addition, there are 32 control codes that affect various functions of the terminal program. More about control characters in a moment.

If your Commodore terminal program communicates in ASCII, and there's a 99-percent chance that it does, you'll be able to call national telecommunications (running on mainframes) as well as local BBSs (running on Commodores, Apples, IBMs, or almost any other computer).

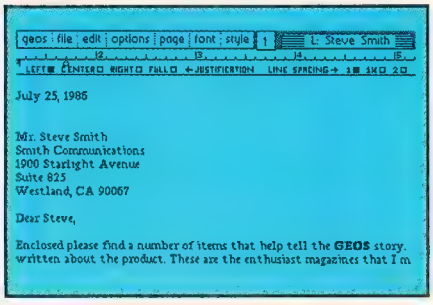
The 128 ASCII codes need seven bits per character, because with seven on/off bits there are 128 unique combinations of 1's and 0's.

THE STRON
ARE BUILT WIT

Whether you're building an argument or just hammering out a memo, any project looks better when you put it together in Writer's Workshop. The supercharger that powers your GEOS-equipped Commodore through even the most wrenching assignments.

Sharpen your skills. The first thing to do in the Workshop is plug into geoWrite 2.0, which contains all the brand new tools you need to hone any rough concept into a well-crafted document.

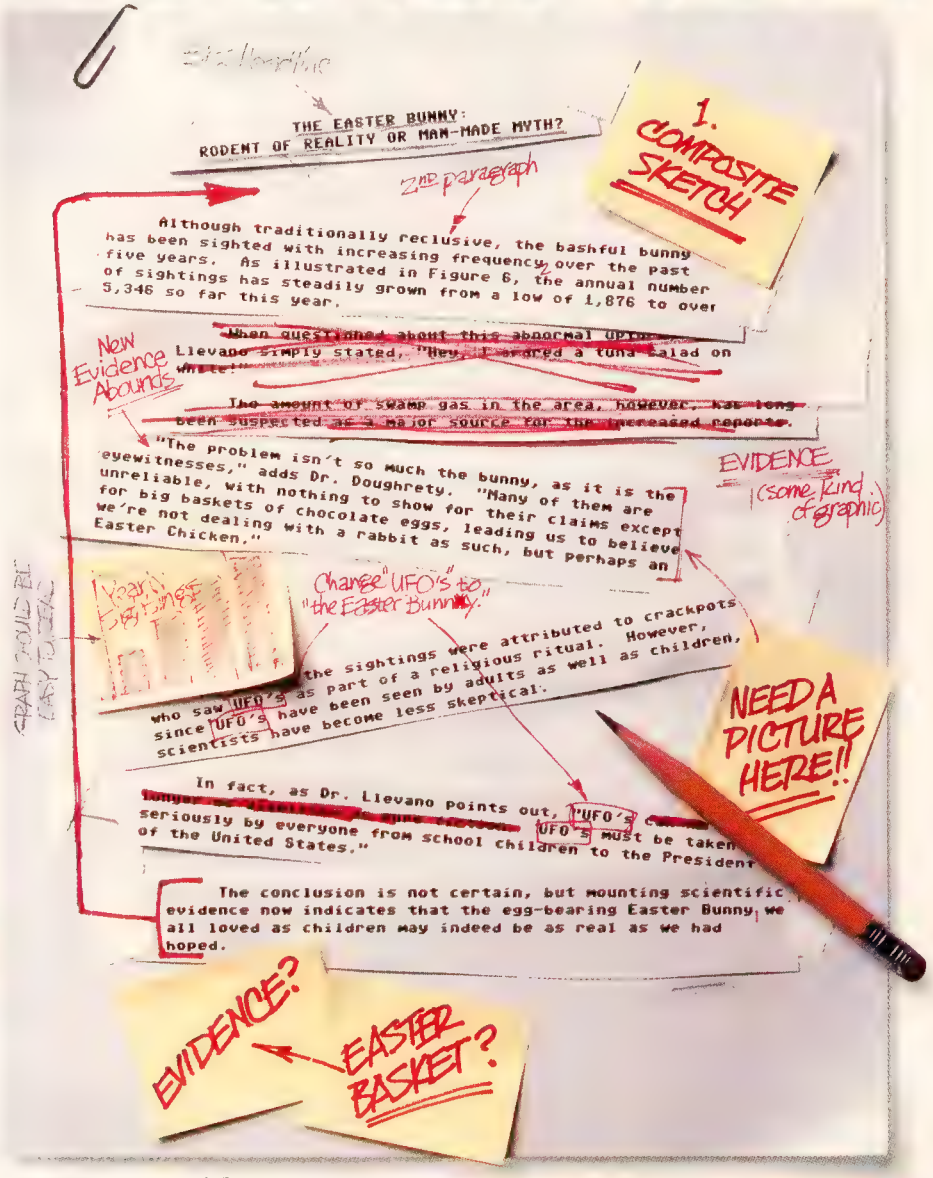
You get headers. Footers. Subscripts and superscripts. You can center your text. Right justify. Full justify. And nail


geos file edit options page font style 1 L: Steve Smith
LEFT CENTERED RIGHT FULL JUSTIFICATION LINE SPACING 1 2 3
July 25, 1985
Mr. Steve Smith
Smith Communications
1900 Starlight Avenue
Suite 825
Westland, CA 90067
Dear Steve,
Enclosed please find a number of items that help tell the GEOS story. written about the product. These are the enthusiast magazines that I m

down formatting problems with variable vertical spacing and adjustable margins.

The Workshop cuts down on your manual labor, too. With one-stroke, "shortcut" keyboard commands. They keep your hands off the mouse so you can keep your mind on your work.

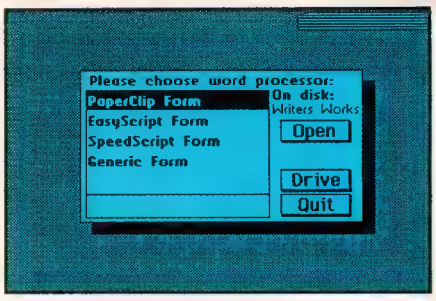
In fact, there's a complete set of heavy-duty accessories that not only strengthen your writing, but reinforce its structure, as well.


THE EASTER BUNNY:
RODENT OF REALITY OR MAN-MADE MYTH?
1. COMPOSITE SKETCH
2nd paragraph
Although traditionally reclusive, the bashful bunny has been sighted with increasing frequency over the past five years. As illustrated in Figure 6, the annual number of sightings has steadily grown from a low of 1,876 to over 5,346 so far this year.
New Evidence Abounds
Dr. Llevano simply stated, "Hey, I ordered a tuna salad on white!"
The amount of swamp gas in the area, however, has long been suspected as a major source for the increased reports.
"The problem isn't so much the bunny, as it is the eyewitnesses," adds Dr. Doughrety. "Many of them are unreliable, with nothing to show for their claims except for big baskets of chocolate eggs, leading us to believe we're not dealing with a rabbit as such, but perhaps an Easter Chicken."
EVIDENCE (some kind of graphic)
Change "UFO's" to "the Easter Bunny."
the sightings were attributed to crackpots who saw UFO's as part of a religious ritual. However, since UFO's have been seen by adults as well as children, scientists have become less skeptical.
NEED A PICTURE HERE!!
In fact, as Dr. Llevano points out, "UFO's must be taken seriously by everyone from school children to the President of the United States."
The conclusion is not certain, but mounting scientific evidence now indicates that the egg-bearing Easter Bunny we all loved as children may indeed be as real as we had hoped.
EVIDENCE?
EASTER BASKET?

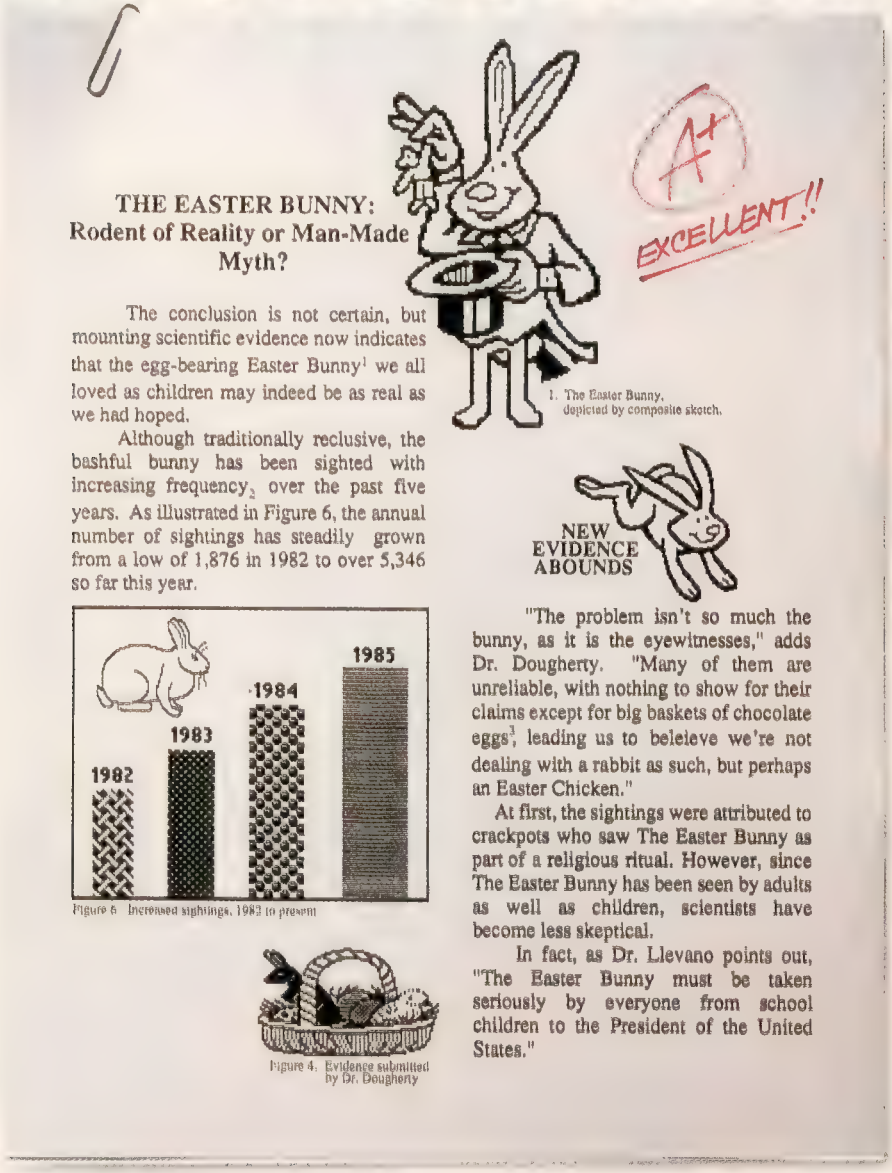
Replace old, worn-out parts. You can build anything with Writer's Workshop. And repair old stuff, too. Just decide which parts have to come out and which new ones go in.

Then hit the key and stand back.

Instantly, the "search and replace" drills through your old



GEST CASES
H A WORKSHOP.



THE EASTER BUNNY:
Rodent of Reality or Man-Made Myth?

The conclusion is not certain, but mounting scientific evidence now indicates that the egg-bearing Easter Bunny[1] we all loved as children may indeed be as real as we had hoped.

Although traditionally reclusive, the bashful bunny has been sighted with increasing frequency, over the past five years. As illustrated in Figure 6, the annual number of sightings has steadily grown from a low of 1,876 in 1982 to over 5,346 so far this year.

1. The Easter Bunny, depicted by composite sketch.

A+ EXCELLENT!!

1982 1983 1984 1985

Figure 6. Increased sightings, 1982 to present

NEW EVIDENCE ABOUNDS

"The problem isn't so much the bunny, as it is the eyewitnesses," adds Dr. Dougherty. "Many of them are unreliable, with nothing to show for their claims except for big baskets of chocolate eggs[1], leading us to beleieve we're not dealing with a rabbit as such, but perhaps an Easter Chicken."

At first, the sightings were attributed to crackpots who saw The Easter Bunny as part of a religious ritual. However, since The Easter Bunny has been seen by adults as well as children, scientists have become less skeptical.

In fact, as Dr. Llevano points out, "The Easter Bunny must be taken seriously by everyone from school children to the President of the United States."

Figure 4. Evidence submitted by Dr. Dougherty

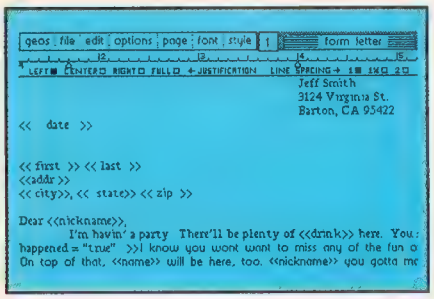
text, replacing worn-out words and phrases with your brand new ones.

For more serious cases, hand the job over to the Workshop's Text Grabber. It takes text from several word processors—like Paper Clip™—and lets you overhaul them with new GEOS fonts, formats and graphics.

A few more built-in features. Every project leaves the Workshop looking beautifully finished, too. Because it not only comes with LaserWriting compatibility, there's even a LaserWriter for you to print on.

You simply upload your files to QuantumLink.™ Then they're printed and mailed back.

Convenient, or what?



Of course, you don't want to keep good-looking documents like this to yourself. So we built in geoMerge. Which customizes your geoWrite form letters to people on your mailing lists.

So if your plans call for some real masterpieces, do something really constructive about it. Call your software dealer and requisition Writer's Workshop.

Who knows? You just might build a name for your self.

To order call 1-800-443-0100 ext. 234
Writer's Workshop $49.95
(California residents add 6.5% sales tax.)
$2.50 US/$5.50 Foreign for shipping and handling. Allow six weeks for delivery.

Commodore is a trademark of Commodore Electronics, Ltd. GEOS, Writer's Workshop and Berkeley Softworks are tradenames of Berkeley Softworks. Paper Clip is a registered trademark of Batteries Included.

WRITER'S WORKSHOP

GEOS COMPATIBLE

Berkeley Softworks

The brightest minds are working at Berkeley.

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When we started our company on the west coast, people thought we were a little spaced out. So you can imagine their reactions when we announced we'd discovered a new universe.

People laughed. People scoffed. And they really freaked out when we told them where we'd found it:

Inside a Commodore 64.

It's called GEOS. And it turns any Commodore into a powerful PC that holds its own against any computer, no matter what kind of fruit it was named after.

GEOS: The superior intelligence. Of course, we always knew Commodores possessed superior brains. It just took GEOS to discover them.

You see, GEOS opens your Commodore to a huge universe that can hold an infinite number of applications. Which means that GEOS can do just about anything the expensive PC's can do, including one thing they can't:

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THE NEW OPERATING SYSTEM STANDARD FOR
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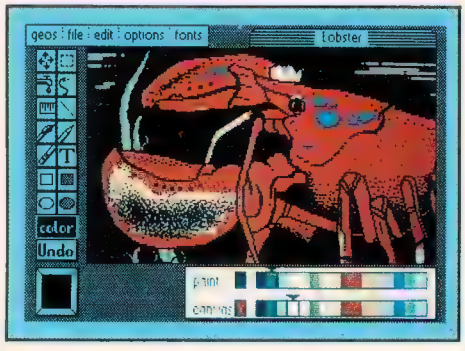

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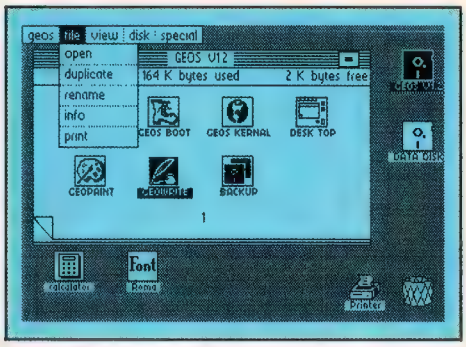

thing about a new universe is finding your way around. But with GEOS, you only need to remember two things:

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When GEOS offers you options, you just point to your answers and click your mouse or joystick.

You want to draw? Point and click.

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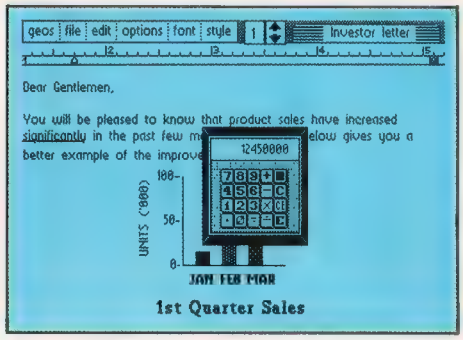

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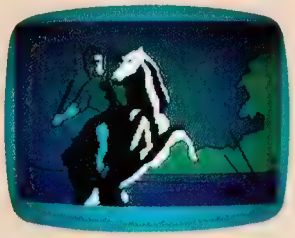

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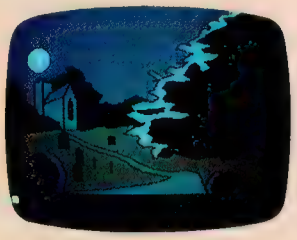

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The eighth bit is often used as a parity bit, which is a simple sort of checksum. If both computers are set for even parity, it means each character transmitted will contain an even number of *on* bits. A capital *T* has the ASCII code 84 ($54), which looks like this in seven-bit binary: 1010100. If parity is even, an additional 1 is added at the beginning (11010100) to maintain an even number of 1's. Instead of $54 (the ASCII code), a $D4 (ASCII with even parity added) represents the letter *T*. When the 11010100 comes over the phone line, the receiving terminal program strips off the extra (eighth) bit.

Most terminal programs come preset to the most common transmission standards. The two you'll see most often are "7-bit words, 1 stop bit, even parity" (especially on services like CompuServe) and "8-bit words, 1 stop bit, no parity" (common on many BBSs).

First Try

If you're brand-new to telecommunications, it might help to experiment by calling a friend first. If anything goes wrong, you can always pick up the phone and talk about what to do next. The computer you're calling doesn't necessarily have to be a Commodore; as long as it communicates in ASCII, you should be able to type to each other.

If you don't make any connection at all, you might have one of the following problems:

- Is the phone line coming into the plug marked *line*? The cable from the wall should *not* be in the modem jack labeled *phone*.
- If the modem has a separate power supply and on/off switch, is it plugged in and turned on? Most Commodore-compatible modems draw their power from the user port and don't have a separate power switch, so you don't usually need to check whether the modem is turned on.
- Are you dialing correctly? If you're dialing by hand, there should be a command in your terminal program that takes the phone off the hook (alternately, some modems like the 1650 have a Telephone/Data switch, which should be on T when you dial and D when you're connected). After you make the connection, take the phone off the hook via the switch or the command.
- If the terminal program is dialing for you, it will generally indicate when a connection has been made, with a message like *Terminal Mode* or *Carrier Detected*. In some parts of the country, the local phone system supports only pulse dialing. A modem that dials by generating touch tones won't work in these areas. (If your local phone system allows tone dialing, either tone or pulse will work.)
- Some terminal programs work with many different types of modems. You may have to tell the program what kind of modem you're using. If your modem is not listed, it's usually either 1650- or 1660-compatible. For 1200-baud modems, you may have to choose the Hayes-compatible (or RS-232) option.
- You should be operating at the same baud rate. If your modem is running at 300 baud but the computer at the other end is set for 1200 baud, you won't be able to communicate. (Some 1200-baud modems will automatically switch to 300 baud if the other modem is working at 300.)

When you're writing a program, a single typing error can mean the difference between a program that runs and one that doesn't. The same is true for downloading.

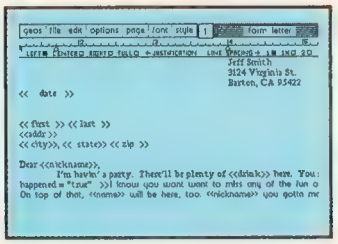
ARE YOU SEARCHING FOR FRIENDS?

If you're finding it increasingly difficult to find anything at all, maybe it's time you found out about geoDex. The GEOS-compatible directory that generates mailing lists. Prints address labels. And sorts out all sorts of things for your Commodore.

Try directory assistance. With a little help from geoDex, you can call up a directory organized from any three categories you choose. Which means you can list your friends by name, telephone number or almost anything else that can be assigned its own three-character code.

Like "MEN" for guys you know. Or "GRL" for girls you know. Or "FOX" for girls or guys you'd like to know.

But no matter how you choose to categorize them, if you can point and click a mouse, you can call up any list of friends with geoDex's easy-to-read graphics.



Our most inviting feature. Of course, once you've gotten your friends organized, the next thing we recommend you do with geoDex is really very simple.

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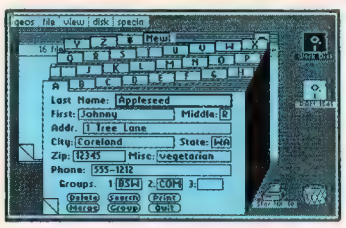

Put them both together with geoMerge and it's toga time!

The search is over. So if you're tired of looking for friends, waltz right down to your software dealer and ask him for geoDex. We can't guarantee it'll win you more friends, but it'll certainly keep you from losing them.

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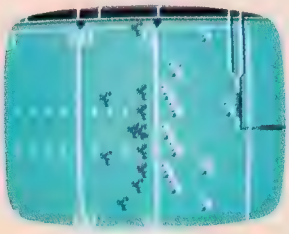

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• One computer should be set for originate, the other for answer. Many modems have a switch labeled O/A; you may have to set the terminal program as well. In general, you should always be in originate mode for calling BBSs and telecommunications services (which are always set to answer), but when you call another person, one of you has to go to answer mode.

Once you've gotten through to the other person, you can start typing back and forth. At this point, a few more things could go awry:

• If you see nothing but garbage, there's a slight chance that you have a lot of static on the phone line. More likely, you aren't communicating with the same parameters. Break the connection and decide between you to use either "7 bits, 1 stop bit, even parity" or "8 bits, 1 stop bit, no parity," the two most common sets of parameters. The problem should clear itself up.

• In general, you should both be communicating at full duplex, which means that when you type a character, it's sent to the other computer and then echoed back to your terminal. If the phone line is noisy, you'll see an occasional character that was mangled on the trip over or the trip back. In half duplex, your terminal program sends the character *and* prints it to the screen. If you're in half duplex and the other person is in full duplex, you'll see doubled characters, lliikkee tthhiiss, because the terminal program on your end of the line is printing the characters to the screen and they're also being echoed back to you. If you're in full duplex and the other person is at half, you'll see his messages but won't see any of your own. Almost all BBSs and services use full duplex.

• If upper- and lowercase letters are reversed, as in "hELLO. aRE YOU THERE?" it means that one of you is sending characters in true ASCII and the other is using Commodore ASCII. Once in a while, you'll see a terminal program that uses Commodore's own variation of ASCII, but most services work only with true ASCII.

• There's usually a way to turn linefeeds off and on from within your terminal program. If the screen is double-spaced, turn linefeeds off. If the screen is zero-spaced—that is, if line after line prints in the same place—you need to turn linefeeds on. Some BBSs start with a prompt that asks if you want linefeeds. You should usually answer yes (the worst that could happen is a double-spaced screen).

The documentation should explain how to change various settings in the program. A few functions, like Originate/Answer, may be set by flipping a switch on the modem. However, most options are changed by sending a command to the terminal program.

There are three ways to change settings. One of the most common is to hold down the Commodore key in the lower left corner and press another key on the keyboard. For example, Commodore-O might open the memory buffer and Commodore-C might close it.

Some programs give you menus, the second way to choose settings. Press a key to see the menu and then press another key to pick one of the choices listed. The third way to change parameters is via command line. When the line appears, you type a command such as "dial 5556789".

Some terminal programs use a combination of keys, menus, and command lines. Whichever method your software uses, it's good to learn the most common commands and how they work.

Capturing Text

Almost all terminal programs offer a capture buffer, a section of memory to which you can save (or capture) text from an online service. There's usually a status line that indicates how much memory is left in the buffer.

Strictly speaking, saving text into memory isn't the same as downloading. But it's a useful feature and it pays to learn how to open, close, print, and save the buffer. You may have two separate commands, like Commodore-O to open and Commodore-C to close the buffer. Or there may be a single "toggle switch"—the first time you press Commodore-B the buffer opens, but the next time Commodore-B closes it.

Remember that the incoming text is almost always true ASCII,

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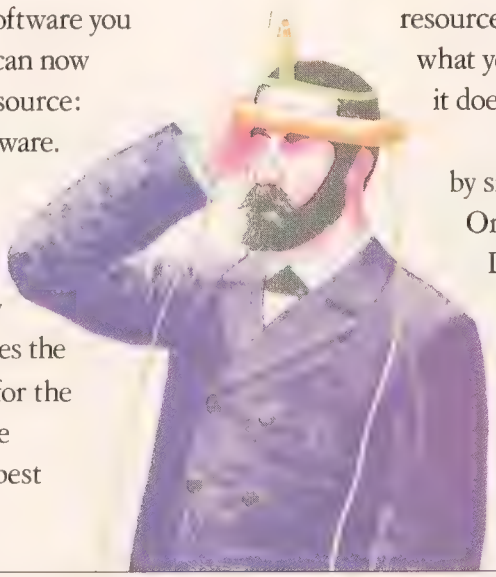

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but it's printed on the screen as Commodore ASCII. Usually, the save command stores the buffer as Commodore ASCII (so you can use a word processor to look at it later). Some programs have a separate store-unformatted (or save-without-translation) option which saves the file in true ASCII format.

You'll often have two other options: Send the buffer to the printer and review the buffer on the screen. Some full-featured terminal programs also provide editing commands so you can change text that's stored in the buffer. The terminal program acts as a limited word processor.

A memory buffer is great for uploading and downloading messages that include printable characters. But buffers are *not* usually suitable for downloading programs, for three reasons: the eighth bit, control codes, and static on the phone lines.

The Problem Of The Eighth Bit

Remember the example above, where the letter *T*—ASCII 84 (hex $54)—was sent as the number 212 ($D4), because of even parity? Since printable ASCII characters fall in the range 32–127, any numbers above 127 have the high bit stripped off. So, when 212 is received, your terminal program automatically subtracts 128 to get 84 (the letter *T*).

Stripping off the eighth bit is fine when you're dealing with ordinary letters, but when it comes to machine language or BASIC programs, quite often the numbers 128–255 are essential to the program. With programs or data files, it's important to save the bytes exactly as they're sent, with no translation or modification.

Another problem on Commodore machines is the conversion from true ASCII to Commodore ASCII. By the time the capture buffer is finished subtracting 128 and changing the numbers around, the program in the buffer looks nothing like the original program that was sent.

The various calculations that strip off the eighth bit and convert to Commodore ASCII are important when you're sending text. But when you're uploading or downloading, these features become a nuisance and should be turned off.

The second problem can be even worse.

Control Codes

Let's say you've logged onto a bulletin board and a long, very interesting message comes into view. It starts printing and gradually fills up the screen, scrolling line after line, too fast for you to read.

To pause the output, just hold down the CTRL key and type S. CTRL-S almost always causes the computer sending the message to stop. To resume the scrolling, press CTRL-Q. The ASCII equivalents of CTRL-S and CTRL-Q are CHR$(19) and CHR$(17). Another common control code is CHR$(3), CTRL-C. This tells the main computer to stop what it's doing; it usually puts you back in the main menu. Another code, CTRL-Z (CHR$(26)), is often used to mark the end of a message. And CTRL-H (CHR$(8)) generally means backspace; on most systems it deletes the most recently sent character.

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While you're reading messages, the control codes (ASCII characters 0–31) act as special commands to the BBS or telecommunications service you're on. These codes pose a problem when you want to upload or download.

The characters 19, 17, 3, 26, and 8 can occur at numerous places within a program, whether it's written in BASIC, machine language, or something else. These characters can also be found in data files you might want to transfer over the lines. When you're sending or receiving a program, you want CHR$(8) to appear as a CHR$(8). It shouldn't be translated to a backspace.

Static On The Line

Telephone lines aren't perfect; once in a while a bit of static will interfere with whatever messages are being sent. Static doesn't usually disrupt voice communications, but it can be deadly to program transfers.

When you're writing a program, a single typing error can mean the difference between a program that runs and one that doesn't. The same is true for downloading. If static on the line changes one character, the program may not work correctly.

Downloading Protocols: Xmodem

It should be clear by now that opening up a memory buffer and capturing incoming characters is dandy for saving normal messages and text files, but it's not very reliable for transferring programs.

That's why downloading protocols were invented. The most popular is called *Xmodem* (sometimes called *Modem7*). There are versions of Xmodem for every microcomputer. You could use Xmodem, for instance, to upload a Commodore program to a bulletin board running on an Apple or IBM. If you downloaded the program later, it would work perfectly, even though it had lived for a while on another brand of computer.

Xmodem treats all characters and bytes as eight-bit entities, although some systems will provide a seven-bit option for Xmodem transfers of ASCII files. The file is divided into 128-byte packets, which are sent one at a time. Within each packet, control codes don't count. A CHR$(8) is a CHR$(8), not a backspace. Sending eight bits (instead of seven) solves the problem of the eighth bit; ignoring control-code commands solves the problem of special characters.

Xmodem gets around line noise by adding a checksum to the end of each block. The sending computer adds up the 128 numbers and appends the sum to the end of the packet. In the meantime, the receiving computer also adds up the numbers. The two checksums should match exactly. If they don't, it usually means that some static has intervened and garbled one or more of the whistles. When something goes wrong, the receiving computer transmits a signal that tells the sender to try again.

A total of 132 bytes makes up an Xmodem block. The first byte is a signal that means "Get ready; here comes a block." The second is the block number (if the file is longer than 255 blocks of 128 bytes,

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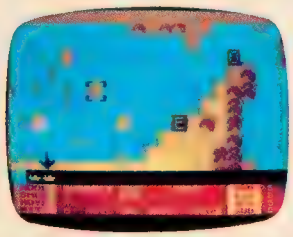

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about 32K, the block number wraps around to zero). The third is the block number subtracted from 256. For block 50, the second and third numbers would be CHR$(50) and CHR$(206). The next 128 bytes are the program or file data. The final byte is the checksum as calculated by the sending computer (if the checksum is higher than 256, subtract 256 until you get a number between 0 and 255, or just AND with 255).

After each block is sent, the sending computer pauses for a response from the receiver. There are three possible answers. One is a code that means "OK. Send the next block." The second means "Something isn't right. Try again." The third possibility is no answer at all, in which case the host computer waits for 100 seconds before aborting the transfer.

Getting Started With Xmodem

Downloading with Xmodem isn't difficult. The main thing you have to know is how to tell your terminal program to start a download. Depending on the software, you'll have to call up a menu, press a key (Commodore-X for Xmodem or Commodore-R for Receive), or type something on a command line (for example, *XR filename,P* might mean Xmodem Receive a PRG file).

After logging on to the bulletin board or telecommunications service, go to the download area and select a program to download. The service will say something like "Initiating Xmodem Transfer" or "Ready To Send." At this point, you can start the download. There's no great hurry; the host computer will wait for ten 10-second periods, more than 1½ minutes, before it gives up. During that minute and a half, you have to tell your computer to start the download—by using the menu, the key, or the command line. At the same time, you need to give it a filename for saving to disk. In general, the filename can be anything you choose; it doesn't have to be the same as the filename on the BBS.

From the moment you start the Xmodem transfer, everything is automatic. Many programs will print a character on your screen to indicate each block that has been received successfully. Some terminal programs will also print the current block number.

If something goes wrong, like a broken connection or an exceptionally noisy phone line, the sending computer will try ten times before giving up. When you've finished, you can download another program or go to other areas of the system. After logging off, check the disk directory; the file you've downloaded should be there.

System-Specific Protocols

Some of the large telecommunications services have their own protocols for downloading. On QuantumLink, for example, you use a terminal program that works only on QuantumLink. Downloading is automatic. You choose a file, give it a name for your disk, and the download begins without any trouble.

CompuServe can be accessed by almost any terminal program that communicates in ASCII. To download from CompuServe, your terminal program should support either Xmodem or CompuServe-B protocols. Files on CompuServe have six-character names followed by a period and an extension. The .IMG extension means a file was uploaded with CompuServe-B protocol, while .BIN means it was uploaded with Xmodem. Extensions such as .DOC, .TXT, and .ASC mean the file is ASCII characters (text or documentation); such files are often instructions for programs, or help files that explain some aspect of CompuServe.

With CompuServe's *Vidtex* program, or any other terminal that supports CompuServe-B protocol, downloads are almost automatic. A file that ends with .IMG contains a header that indicates whether it's a program or sequential file. .BIN files don't contain this information, so you have to add ",p" to the filename (SPACEGAME,P for example) to download it as a PRG file.

If you're using Xmodem on CompuServe, .BIN files will transfer without fuss. But when you're downloading .IMG programs, the header that indicates what type of file it is may cause some problems. Some Xmodem programs automatically strip off the header from .IMG files. If your program doesn't do this, you'll have to download a separate program called BINIMG.BIN

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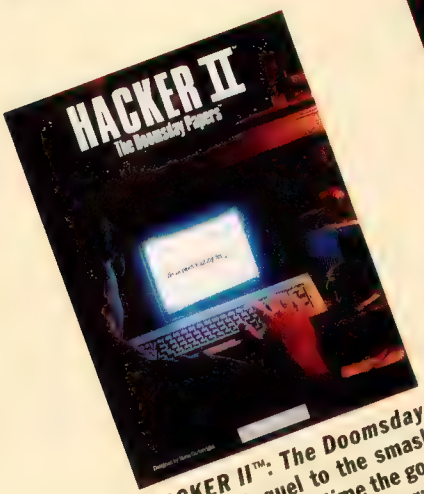

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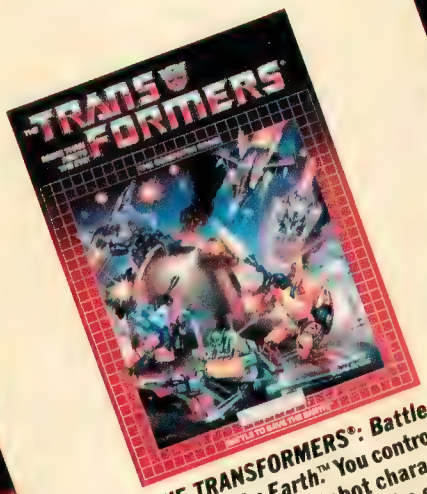

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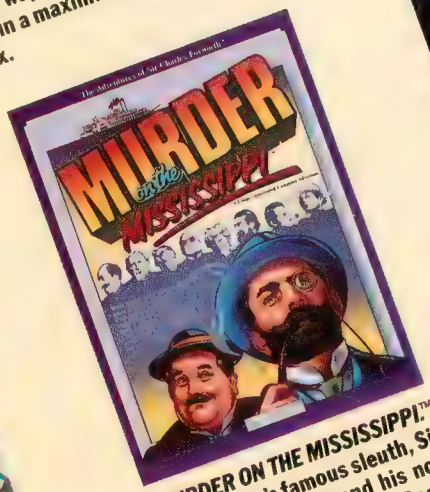

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that removes the CompuServe header from .IMG files.

A BBS that runs on a non-Commodore machine (Apple, Atari, IBM, Radio Shack, or other brands) will almost always use ASCII for the messages. If there's a download area, you'll probably need a terminal program that supports Xmodem protocol.

Commodore bulletin boards usually run in standard ASCII, although some might use Commodore ASCII instead. If upper- and lowercase letters are switched, then you'll need to adjust your terminal program (or find one that uses the right kind of ASCII). A popular transfer protocol for systems running on 64s is called "Punter protocol," after its inventor, Steve Punter (who also wrote the word processor *WordPro*). The use of Punter protocol has generated heated discussion among sysops of Commodore bulletin boards. One side argues that Punter uploads and downloads are faster and often more reliable than Xmodem. Others say that Xmodem has long been the standard and that Punter (as a Commodore-specific protocol) keeps many non-Commodore users away.

Squeezing And Libraries

Owners of the 128 who use CP/M mode to call CP/M bulletin boards (or visit the CP/M area on a national service) will almost certainly run into squeezed files and library files. After you've downloaded a squeezed file, you have to unsqueeze it with the CP/M program called USQ-.COM before you can use it. For library files, you need a program called NULU.COM (NULU means *new library utility*). Both USQ and NULU are public domain programs, and they're usually available on the BBS or service that contains the squeezed or library files.

Squeezing and libraries are common on CP/M machines. They're becoming very popular on Commodore computers as well.

The idea behind squeezing is that you start with a program or data file and run it through a utility that makes it smaller without losing any information. The smaller file takes less time to upload and download and also saves disk space. A file that's originally 30K long might squeeze down to 24K (a savings of 20 percent). When you call a service like CompuServe or make a long distance phone call to a bulletin board, you're paying by the minute. If the file is smaller, you pay less for the connect time.

One way to squeeze a text file is through Huffman encoding, which takes the characters that occur most often (space, *e*, *t*, *a*, *o*, *i*, *n*, and so on) and sends them as a smaller number of bits: four, five, or six, instead of seven or eight. This is similar to Morse code, where the letter *E* is a dot and *T* is a dash. Since these are the two characters most often used, messages are sent faster if the popular codes are short.

Graphics files can be squeezed with *run length encoding* (RLE), which looks for repetitions of certain characters. If the character color for a Commodore screen is purple on the top row (40 characters) and blue on the new two rows, color memory will hold 40 fours followed by 80 sixes. An RLE file, instead of 120 characters, might contain a CHR$(40), CHR$(4), CHR$(80), CHR$(6), which means repeat 40 times the number 4, and then repeat 80 times the number 6. Hi-res pictures are often squeezed using this method. *GEOS* pictures are also stored in RLE-type files.

Library utilities are useful when a single program needs several files—say, a BASIC program that has a separate ML program and a data file. Instead of having to download three separate files, you download the single library file and then use the NULU (or other library programs like ARC220) to dissolve the library into its constituent parts. Library utilities usually perform some sort of squeezing at the same time.

Most systems recognize the HELP command ... and will respond with a list of possible actions and things you can do while you're online.

Asking For Help

If you're new to telecommunications and modems, there are many sources of help. User groups usually have several members who are knowledgeable about the arcana of modems; many user groups also have several public domain terminal programs available at a nominal cost (generally $2–3 to cover the cost of the disk). Some user groups also sponsor a bulletin board.

Whenever you're puzzled by a certain aspect of downloading, leave a message for the sysop. If you explain what you're trying to do and what happened, the sysop will generally offer some suggestions. If you leave a public message, you'll often get a reply from experienced members, offering suggestions and hints.

Most systems recognize the HELP command (sometimes just H or ?) and will respond with a list of possible actions and things you can do while you're online.

It never hurts to experiment, either. If the first thing you see when you log onto a BBS is "LF (Y/N)?" it's probably a reference to whether or not you want linefeeds. You might not know if you want linefeeds, so take a wild guess. There's a 50-percent chance you'll get it right. If things don't look right, log off and try again. The commands OFF, BYE, EXIT (or just X) will usually get you out. The most drastic way to leave is to simply turn off your computer.

There are a lot of good programs available on bulletin boards and telecommunications services. With a little perseverance, you'll soon be downloading some great programs.

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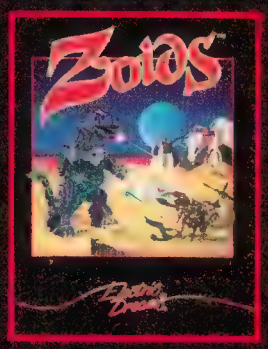

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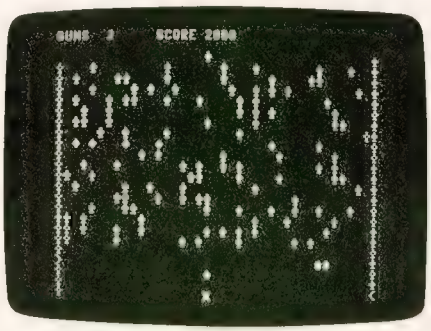
Decipede

James Knesek

You'd better keep moving if you want a high score in this game. Giant spiders, wasps, and dragonflies are among the beasts you'll have to contend with. For the Commodore 64. A joystick is required.

"What a beautiful day for a picnic," you say to yourself as you sit down on the newly mowed grass and prepare yourself for a nice, pleasant lunch. But just as you begin to unfold your napkin, the birds stop singing, the crickets stop chirping, and a dark cloud begins to form in the sky above. A gardener in faded overalls runs by, looking over his shoulder as he scurries along, and shouts, "Better get goin', there's a whole garden full of critters on the move." As you ponder this strange comment, a huge decipede suddenly appears at your side and rudely devours your lunch. The creature, apparently unsatisfied, begins to turn its attention to you. It's a good thing you brought along your insecticide gun today.

"Decipede" is an arcade-style action game that requires skill and dexterity. The object of the game is to destroy all of the assaulting creatures with poison pellets before they have a chance to touch your insecticide gun. At the start of each game, you're given three guns with which to destroy the decipede and the other creatures.



The player (the spade) is being chased by a spider (the large X) as the decipede nears the bottom of the screen.

The Cast Of Characters

Your enemies are not easily defeated. Possibly the most malicious of the bunch is the grasshopper. His diagonal movement in your area makes him hard to destroy and difficult to avoid.

The attack wave ends only after the destruction of the entire decipede (all ten segments) or your own demise. With the successful (from your point of view) completion of an attack wave, the colors of the screen objects change, and the enemies speed up. Each wave starts in a new patch of clover.

Your score is displayed at the end of each attack wave. The scores you receive for destroying the enemies are 25 points for each clover, 50 for each decipede section, 200 for each grasshopper, 400 for each dragonfly, and 1200 for each wasp. You are awarded a new gun every 12,000 points.

The decipede is quite a monster itself as it weaves its way through the clover and down the screen towards your gun. Once it

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has reached the bottom line of the screen, it weaves around in your area of the playing field until either you or it is destroyed. Another formidable enemy is the wasp. She never comes down to your part of the screen, but when she passes over a clover, she changes it to a diamond. A decipede will dive straight down toward you if it runs into one of these diamonds. The least harmful of the attackers is the dragonfly. It usually dives straight down toward you, which makes it an easy target. However, the dragonfly leaves a trail of clover behind which hastens the decipede's dangerous descent.

The insecticide gun can move anywhere within the bottom four rows of the screen. Be careful, because the gun moves very quickly. Hold down the fire button of the joystick for rapid fire.

Getting Started

Decipede has two parts: one BASIC and one machine language. Type in and save Program 1 as you would any other BASIC program. The machine language portion (Program 2) must be typed in with "MLX," the machine language entry program found elsewhere in this issue. Before you begin typing in Program 2, be sure to read and understand the instructions for using MLX. When you run MLX, you'll be asked for a starting address and an ending address. Here are the correct values for Program 2:

Starting address: C000
Ending address: C91F

When you finish entering the data from Program 2, be sure to save a copy with the name DEC ML. That's the name Program 1 expects the file to have (see line 20 of Program 1). For disk users, the DEC ML file must be on the same disk as Program 1. For tape, change the ,8,1 in line 20 of Program 1 to ,1,1. Also, be sure that the DEC ML file immediately follows Program 1 on the tape.

When you're ready to play Decipede, load and run Program 1. Be sure that the joystick is plugged into port 2. When the title screen appears, press the joystick fire button to begin play.

See program listings on page 118.

Connect 'Em

Francis Chambers

This program is an adaptation of the classic "Connect the Dots" game, updated to allow you play against a friend or the computer. Or you can watch the computer play against itself. For the Commodore 64, 128, Plus/4, and 16. One or two joysticks are required.

As you probably recall, the venerable game "Connect the Dots" begins with a grid of dots drawn on a piece of paper. Two players take turns drawing lines connecting the dots. If you complete a square, you put your initial in it and move again. When all the squares have been captured, the player with the most wins.

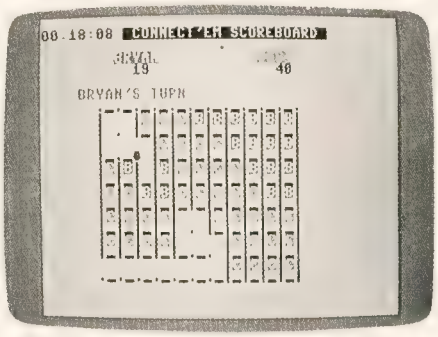
Playing the game is even easier on the computer. In "Connect 'Em," the computer draws the dots and lines, and keeps a running count of the scores. The game also lets you play against a friend or the computer, or sit back and watch the computer match wits with itself.

There are two board sizes to choose from—regular (84 boxes) and mini (42 boxes).

Type in and save a copy of the version for your computer—Program 1 for the 64 or Program 2 for the 128. The 128 version will also work on the Plus/4 and Commodore 16 with the following modifications:

```
DX 50 PRINT"{CLR}":S=3072:C=-1
      024:RR=205:CC=1339:CH=81
      :CL=2:OX=46:P1=0:P2=0:IN
      $="":LX=28:UX=12
KF 680 PRINT"{BLU}TO PLAY AGAI
       NST THE COMPUTER,":PRIN
       T"ENTER {RED}PLUS4{BLU}
        OR {RED}C-16{BLU} FOR"
BX 730 NC(T)=F1+16*4:IF PL$(T)
       ="PLUS4" OR PL$(T)="C-1
       6" THEN F2=F2+1:PC$(T)=
       "X"
```

After you've typed in and saved the appropriate version, load the program and type RUN. The computer asks for the names of the players. If you want the computer to play either or both positions, enter the name C-64, C-128, PLUS4, or C-16, depending on your computer.

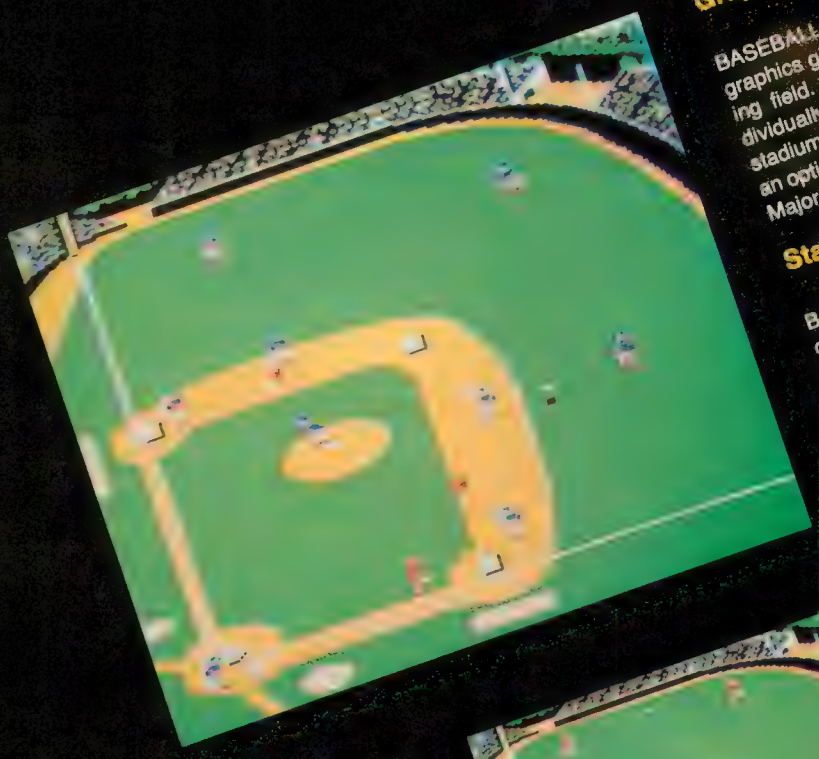


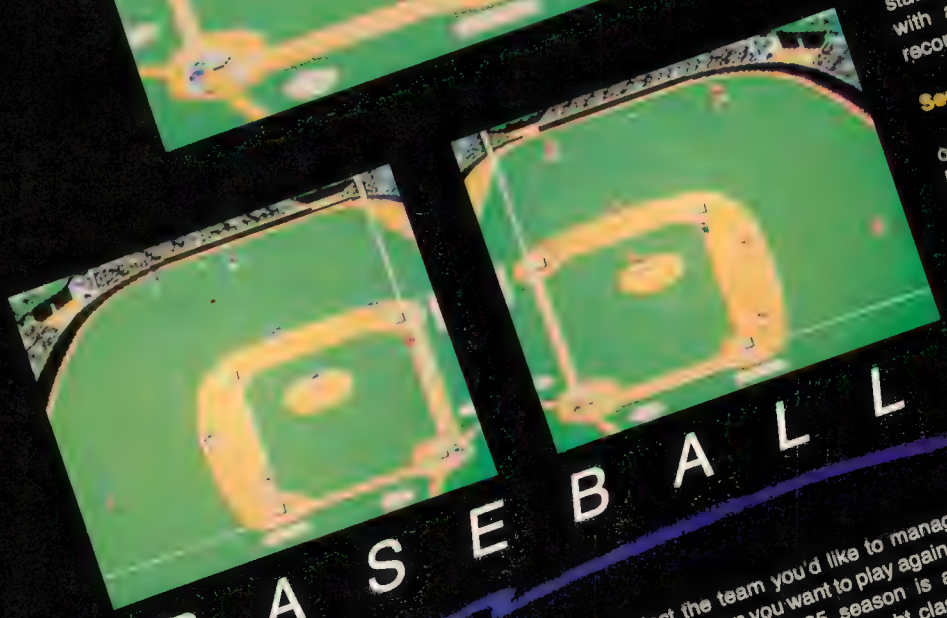
The computer is an intelligent foe in "Connect 'Em."

The computer moves on its own, but people need to use a joystick (player 1 uses port 1 and player 2 uses port 2). To make a move, use the joystick to place the marker (a little blue ball) on one of the dots that you wish to connect; then press the joystick fire button. Now move the marker to the other dot and press the fire button again. A line will be drawn connecting the two dots. Only adjacent dots can be connected. The computer doesn't make illegal moves, nor does it allow you to make them.

When a square is captured, the appropriate initial is placed in it. (Don't worry if both players have the same initials—the squares are also color-coded.) At the end of the game, the computer displays the winner's name.

See program listings on page 111.





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Controlling Scrolling

Charles Allison

Did you ever wish you could have a menu at the top of a screen that didn't scroll away as text filled the screen? This short program allows you to keep a message or menu at the top of the screen. It transfers the operating system to RAM and alters a single byte of the scrolling routine.

```
HC 10 DATA 169,160,133,252,169
      ,222,133,254
HE 20 DATA 169,0,133,251,133,2
      53,160,0,177
JJ 30 DATA 251,145,251,177,253
      ,145,253,136,208,245,230
      ,252,230,254,208,237,96
MD 40 FOR T=49152 TO 49185:REA
      D A:POKE T,A:NEXT T
DP 50 SYS 49152:POKE 59639,10
GQ 60 POKE 1,PEEK(1) AND 253
KE 70 PRINT"{CLR}":LIST
```

Run the program. Now list it a couple of times. See how the top lines stay put while the rest of the screen scrolls by? If you'd like the message area to be a different size, put the desired number of screen lines minus one into the POKE statement in line 50. For example, if you want three lines for a message or menu, type POKE 59639,2. If you POKE a number greater than 24, scrolling is disabled completely. POKE 59639, 255 to return to normal scrolling.

The bottom scroll line can also be changed. Try this: POKE 59652,20.

Quick Character Editor

Mitchell Ross

There are many excellent utilities for designing custom characters on the 64. But if you just want to create one character, it's a lot of trouble to load in a font editor, make the changes, save the new font out to a file, go back to BASIC, and load the font back in. This simple character editor is perfect in such cases. Just design the character in the DATA statements. Use the cursor keys to move around and alter the character. In the program below, a small man has been designed. Be sure to press RETURN on each data line after it is displayed on the screen.

```
MX 10 DATA "{2 SPACES}****
      {2 SPACES}"
XS 20 DATA "{2 SPACES}****
      {2 SPACES}"
MA 30 DATA "{3 SPACES}**
      {3 SPACES}"
PQ 40 DATA "********"
GB 50 DATA "** ** **"
AD 60 DATA "{2 SPACES}****
      {2 SPACES}"
HC ?70 DATA " **{2 SPACES}** "
MC 80 DATA "**{4 SPACES}**"
MH 90 INPUT"LINE NUMBER FOR DA
      TA LINE";DL
AK 100 PRINT DL;"DATA";
BH 110 FOR I=0 TO 7:READ A$:T=
       0:FOR J=0 TO 7:B=0:IF M
       ID$(A$,J+1,1)="*" THEN
       {SPACE}B=1
JF 120 T=T+B*2↑(7-J):NEXT:PRIN
       TT"{LEFT},";:NEXT:PRINT
       "{LEFT} "
```

When you're satisfied with the character you've created, type RUN. You'll be asked at which line number you'd like to create the data. For now, answer 10000. The program will respond by displaying the data for the character. This program reads the character DATA statements and prints out the equivalent numeric data. You can either write down the values and use them later, or you can run the cursor up to the DATA line and press RETURN to enter it into the program. This should be a great help any time you need a new character quickly.

If you want to see how your new character looks, follow these instructions:

1. Type in the program below.
2. Run it.
3. Choose 3 as the DATA line number.
4. Press RETURN on the DATA line.
5. Type GOTO 130.
6. Press @ to see your character.

```
DM 125 STOP
BK 130 POKE 52,48:POKE 56,48:P
       OKE 56334,PEEK(56334)AN
       D254:POKE 1,PEEK(1)AND2
       51
MK 140 FOR I=0 TO 511:POKE I+1
       2288,PEEK(I+53248):NEXT
       :POKE 1,PEEK(1) OR 4
CE 150 POKE 56334,PEEK(56334)O
       R1:POKE 53272,(PEEK(532
       72)AND240)+12
QB 170 FOR I=0 TO 7:READ A:POK
       E 12288+I,A:NEXT I
```

Default With Variables

Joseph R. Charnetski

Many programmers use a statement with the following general format to give the user a default choice when answering an input prompt. (A default choice is one that will be selected if the user presses RETURN instead of typing in an answer.)

```
INPUT"PROMPT{2 SPACES}Y{3 LEFT}
  ";A$
```

This works very well most of the time. The {3 LEFT} makes the cursor back up over the Y. If you want to use YES instead of Y, then you'd have to use {5 LEFT} instead.

You can see the problem: What if the length of the default answer is unknown? What if the variable is a number or word? The solution is to do something like this:

```
PRINT"PROMPT ";X;:POKE C,6:INPUT X
```

where C is 211 for the 64 and the VIC, 202 for the Plus/4 and the 16, and 236 for the 128. This forces the cursor to go to the column indicated by the POKE. In this case, the cursor goes to the sixth column. Of course, if you change the prompt, you'll have to change the column number to the number of characters in the prompt. If you use this technique with a string, type two spaces after the prompt instead of one.

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Keyword Construction Set

Rick Bauer

This clever utility lets you easily change the spelling of any BASIC keywords. It's especially helpful if you speak or teach a language other than English. A French or Spanish version, for example, would be easy to create. For the Commodore 64.

BASIC has many commands and statements. Keywords like PRINT, INPUT, RUN, and NEW are all built-in. "Keyword Construction Set" lets you replace some or all of these words with new ones. For example, if your first language is Spanish, you can replace BASIC keywords with Spanish words of your choice. Since I usually program in machine language, I made the following alterations to BASIC: I replaced PEEK with LDA, POKE with STA, GOSUB with JSR, RETURN with RTS, and GOTO with JMP. This makes it easier for me to translate BASIC programs into machine language. Of course, you may just want to use Keyword Construction Set to experiment with some new keywords while programming. It can be refreshing to see WRITE A,B,C instead of PRINT A,B,C.

Keyword Construction Set is written in BASIC. To use it, type it in and save a copy. Load it; then type RUN. You're prompted for the name of your "new" language. The program uses this response as the filename for your modified BASIC language. Next, the program asks if you want a list of your new keywords to go to your printer. Printing out your keywords is a good idea—otherwise, you may find you've forgotten a few of them the next time you sit down at your computer. The program assumes that your printer is connected as device 4. If this isn't the case, change the OPEN statement in line 200. For example, if your printer is device 5, change the second 4 in the OPEN statement to a 5.

Choosing Your Words

Now you're ready to enter your new instruction set. The ROM (Read Only Memory) keywords are listed one at a time on the screen. As each one is displayed, type in your replacement keyword. If you want to use the standard BASIC keyword, just press RETURN. The new keyword can be any length, but the total number of characters in all keywords must not exceed 255. Since there are 76 keywords that can be changed, your new keywords should average four to five characters. The top line of the screen tells you how many characters you've used so far and how many characters are over or under the original set (try to keep this number less than or equal to zero). For example, if you replace NEW with ERASE, you should compensate by making another keyword two letters shorter (SAVE into SV, for example).

If a keyword ends with a special character, like $ or), it's a good idea to retain that character in your new keyword. If you don't, things could get unnecessarily confusing. When you finish (the last keyword to change is GO), the computer asks whether it should save your language to disk or tape. Answer D for disk or T for tape to create a machine language file of your modified BASIC.

When you want to use your new dialect of BASIC, type these lines:

```
LOAD "filename",8,1
NEW
SYS 49152
```

Now your keywords are enabled. Load a BASIC program to test your language. Type LIST. You should see your keywords in the BASIC program. You may return to the standard BASIC definitions at any time by pressing RUN/STOP–RESTORE. Type SYS 49152 to reenable your new language.

See program listing on page 115.

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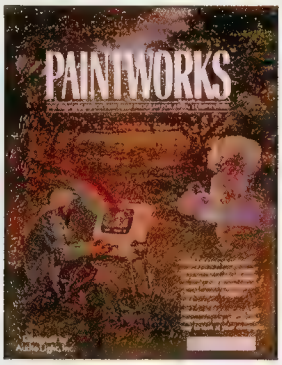

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Mastering 128 Sound And Music

Part 4

D. C. Holmes

In this installment, the author examines the FILTER statement, an important function in refining sound on the 128. Included are two impressive musical demonstrations of the techniques.

Last month, we discussed the principles of tonal quality and learned how to use the ENVELOPE statement. This month, we'll examine the FILTER statement, a tool which allows us to further refine the timbre of a sound on the 128.

Filtering operates by the process of *subtractive synthesis;* that is, the final sound is achieved by selectively eliminating certain overtones from the waveform prescribed by an ENVELOPE command. As an example, imagine a horn player who comes to a session carrying four horns and a box of mutes. He could play his part on a trumpet, a cornet, a bugle, or a flügelhorn. Even though the frequency of the notes would be identical, the timbre of the sounds would be different for each instrument, due to tubing configurations and other unique physical properties of the horns. Likewise, our SID chip can play the same character string using different envelopes, and even though the pitch of the notes is the same, the sounds may be very different.

The musician may choose to fine-tune his sound by using one of his mutes. Muting changes the tonal quality by blocking certain overtones in the natural sound of the instrument, and allowing only selected harmonics to pass through and be heard. He could use a cup mute to produce a muffled, but mellow, sound. Or a Vaccianno mute would give a bright, tinny character to his instrument. Using the same mute on another instrument has a similar effect on that instrument, but the sound of a cup-muted trumpet can still be easily distinguished from the sound of a cup-muted flügelhorn because of the individual characteristics of the fundamental (unmuted) tones. In the same way, we can use the SID filter to block certain harmonics, allowing others to be heard in the waveform of Commodore 128 sounds.

The SID filter system employs three muting filters, which can be used singly or in combination. These are the low-pass, high-pass, and band-pass filters.

The low-pass filter blocks overtones above a specified frequency (the cutoff frequency) and allows overtones below that frequency to be played and heard. This produces sounds which are characteristically full and rich, lacking brightness. This filtering method is illustrated in Figure 1.

The high-pass filter does the reverse: It tells the SID chip to filter out frequencies *below* the cutoff, and allows those above the cutoff to pass through to be heard (Figure 2). These sounds are described as hollow or tinny, as opposed to mellow or solid.

The band-pass filter supresses all but a narrow range of frequencies above and below the cutoff (see Figure 3).

When all three filters are used simultaneously, frequencies throughout the range of the SID chip are allowed to pass (Figure 4). Conversely, when the FILTER is enabled (PLAY"X1"), but all three filters are turned off, no sound is allowed to pass through (Figure 5).

Combining the low-pass and band-pass filters produces essentially a modified low-pass effect. Likewise, combining the high-pass and band-pass gives a modified high-pass effect.

Combining the low-pass and high-pass creates an interesting situation in which a range of frequencies near the cutoff are filtered out, and all other frequencies above and below are allowed to pass through the SID chip. This is often referred to as a notch reject or band-stop filter (Figure 6).

The format for the FILTER statement is

FILTER *cf,lp,bp,hp,res*

where

cf **= filter cutoff frequency (0–2047)**
lp **= low-pass filter on (1), off (0)**
bp **= band-pass filter on (1), off (0)**
hp **= high-pass filter on (1), off (0)**
res **= resonance (0–15)**

The value of the *cf* parameter determines the cutoff frequency of the SID filter, but the numeric value of this parameter should not be confused with the actual cutoff frequency. The frequency at which the cutoff occurs varies according to the frequency of the note played. When

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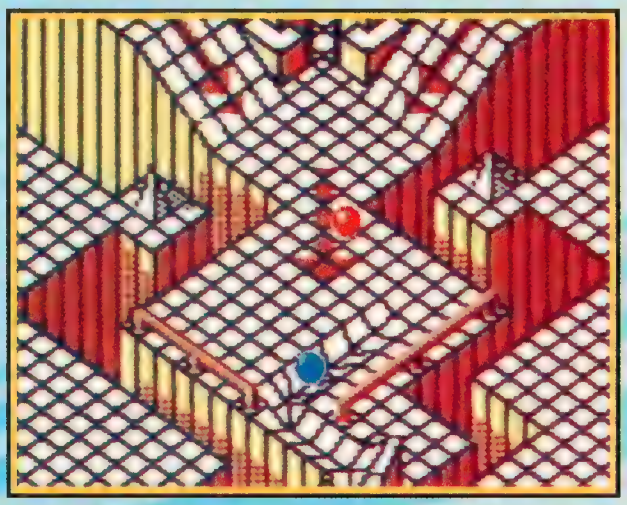

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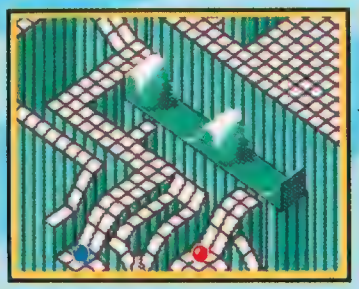

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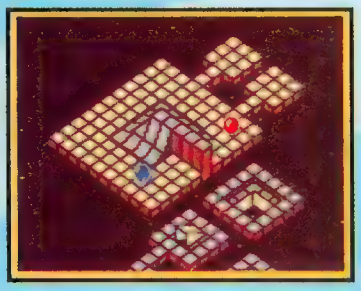

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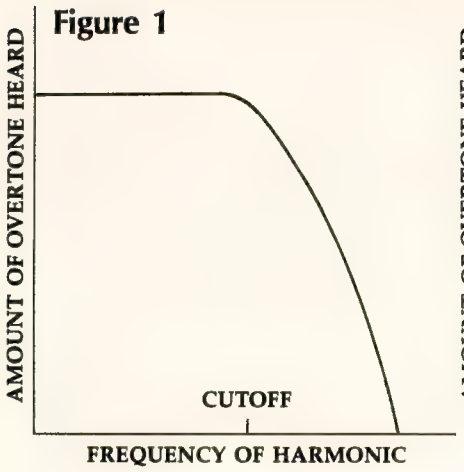

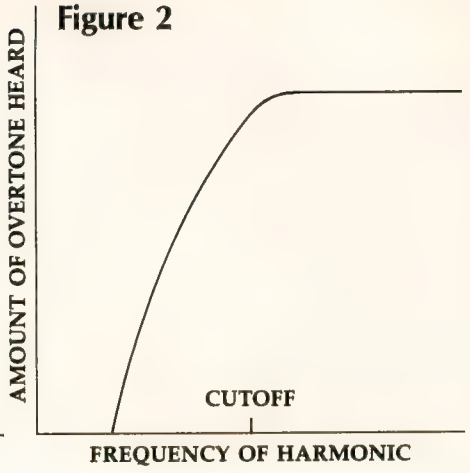

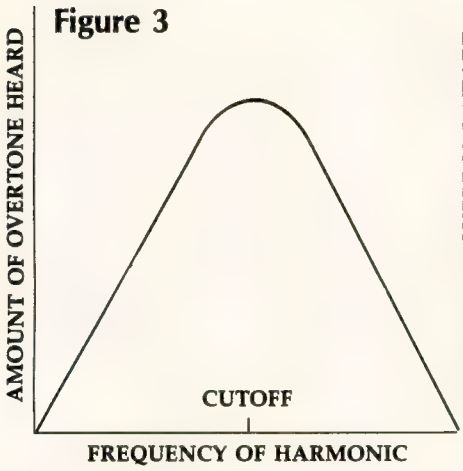

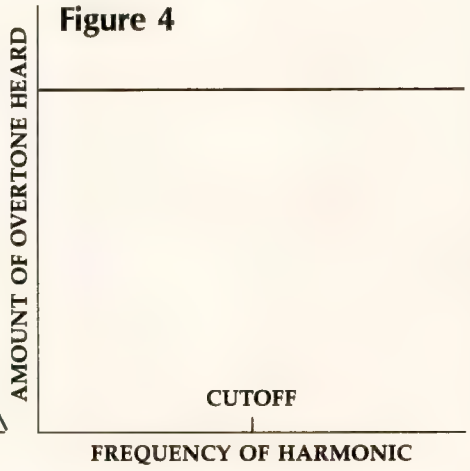

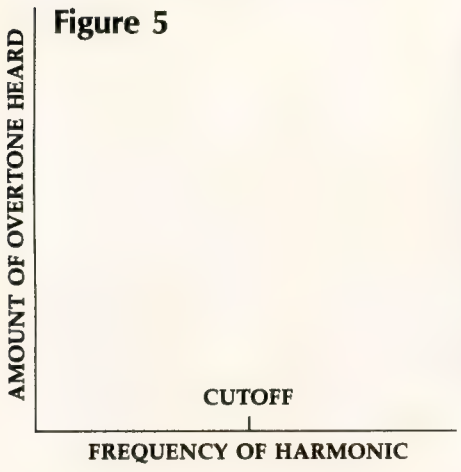

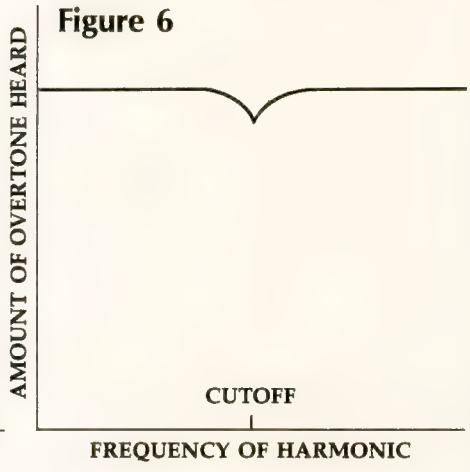

cf = 0, the cutoff will be placed such that it is below the frequency of virtually all of the naturally occurring overtones in a sound. A value of 2047 places the cutoff at a frequency higher than virtually all of the natural overtones. If the cutoff value is 1023, the relative distribution of overtones will determine a cutoff frequency where half of the overtones are below it, and half are above it. Thus, the value of *cf* does not specify the exact cutoff frequency, but rather the amount of filtering desired.

The parameters *lp*, *bp*, and *hp* simply toggle the three individual filters on and off. One, two, or all three may be enabled at the same time, or they may all be turned off.

Resonance is a process whereby frequencies near the cutoff are accentuated. The degree of this peaking effect may range from no resonance (*res* = 0) to very pronounced (*res* = 15). Increasing the value tends to sharpen or clarify the tonal quality.

Through The Filter

Only one filter configuration, specified by a single FILTER statement, may be used by the SID chip at any one time. The same configuration applies to all three voices, and whether or not a voice is filtered is determined by the PLAY statement.

For this, the form of the PLAY statement is

```
PLAY "VnXn"
```

The V*n* command selects the current voice (*n* can be 1–3). If no V command is used, the default is voice 1. The X*n* command specifies whether the current voice will be passed through the filter. Filtering is turned on when *n* is 1 and off when it is 0. The default setting is equivalent to X0 (filtering off). Once filtering is turned on for a particular voice, that voice will continue to be filtered until it is turned off with X0. The same FILTER statement configuration applies to all three voices when they are filtered, but each voice can be individually filtered or unfiltered.

The first of this month's programs, "Saints," includes a filter editor for experimentation. The melody voice plays a line of a Dixieland tune, and then answers in the same envelope, but with the filter turned on. Changing the parameters of the filter will produce noticeable differences in the filtering effect. Only voice 1 is filtered in this program.

Program 2 is named "Joy," and is my computer interpretation of Bach's classic "Jesu, Joy of Man's Desiring." This version is an organ-like arrangement of the well-known work. I always marvel at the way a good pipe organist can filter the sounds by controlling the louvers on the pipe cabinet. Just like the mutes the horn player uses, the openings created by these louvers allow selected harmonic frequencies to pass through, while others are blocked.

Joy (Program 2) brings together most of the topics we've discussed thus far in this series. Use your imagination and play with the TEMPO, VOL, ENVELOPE, and FILTER statements to customize this program.

See program listings on page 116.

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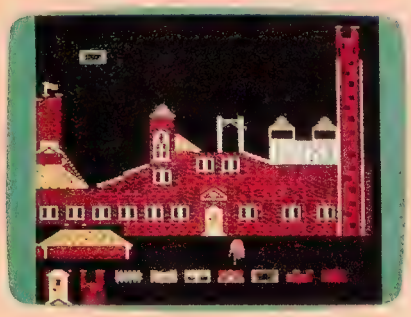

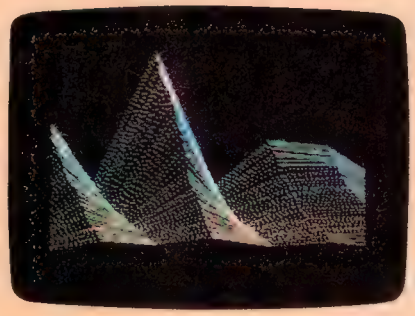

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User Group Notes

The **Promenade User Group of America** has formed to assist users of the Promenade and Commodore 64. For more information on this group, write P.O. Box 4224, White Plains Station, Northbrook, IL 60065-4224.

Commodore Owners of Massena (C.O.M.A.) has a new address: 7 Water St., Massena, NY 13662.

The Downriver Commodore Group has changed its address to P.O. Box 1277, Southgate, MI 48195.

Central Dakota Commodore Club can be reached at Rt. 3, Captain Leach Dr. #18, Mandan, ND 58554.

The **Commodore Technical User Group (CTUG)** has a new mailing address: P.O. Box 8342, Orange CA 92664. Newsletters can still be sent to *Syntax Error*, P.O. Box 8051, Orange, CA 92664.

The new address for **Olympic Peninsula Users' Group** is P.O. Box 1894, Port Angeles, WA 98362.

The **Manitoba Users Group (M.U.G.)** has changed its address to Box 8, Group 351, R.R. 3, Winnipeg, Manitoba, Canada, R3C 2E7.

Toronto Pet User's Group (TPUG Inc.) has moved and consolidated its addresses to P.O. Box 724, Station B, Willowdale, Ontario, Canada M2K 2R1.

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Commodore Mobile Users Group (CMUG), 3993 Cottage Hill Rd., #78, Mobile, AL 36609

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Ridge C-64 Users Group, 94 Ridge Rd., Ridge, NY 11961

Malone Commodore User Group (MALCUG), 27 Bentley Ave., Malone, NY 12953

Triple Cities Commodore Club, 1713 Castle Gardens Rd., Vestal, NY 13850

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CANOCUG, 1014 8th St. NE, Canton, OH 44704

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American User Group, 33754 SE Oak St., Scapoose, OR 97056

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Battlefront

Battlefront is a simulation for the Commodore 64 of four of the most crucial battles of World War II. The fourth strategy game from Australia's Strategic Studies Group (SSG), *Battlefront* continues the menu-oriented design philosophy used by SSG in *Carriers at War* and *Europe Ablaze*. Roger Keating and Ian Trout, the game's designers, believe that the mechanics of strategy games should be simple, contained within a series of easily accessed menus.

Ever since introducing their menu system in *Carriers at War*, SSG has continued to develop it. The menus in *Europe Ablaze* were a little easier to work with, and those in *Battlefront* are easier still. What the menus do, in all three games, is restrict the amount of information to which you have access, with the result of greater "fog-of-war" realism. They also aid your ability to make decisions, and prevent you from making an illegal move.

In *Battlefront*, information access is particularly important, since you are taking the part of the corps commander. In fact, you have absolutely no control over what your troops will do once you've given them their orders. Unlike many war games, *Battlefront* does not allow you to position individual units (except your headquarters), nor can you treat the units as anything *but* a unit. Many war games reward the commander who keeps his units together, but *Battlefront* is the first I've seen that doesn't allow you to do otherwise. You are the corps commander—nothing else.

If this makes *Battlefront* sound rigid and mechanical, it shouldn't. The game is anything but that. *Battlefront* presents you with a strict point of view, but within that point of view you have a great deal to do. As corps commander, you must fulfill a set of objectives over which you have no control, and you must do it by trusting your subordinates to carry out your orders. In other words, the game defines very well your role within the military hierarchy.

To get an idea of how the menus work, let's examine a typical advance-to-contact situation. After a series of preliminary menus which allow you to examine your objectives, your position, and the status of your units, the Division Select menu appears. Here you choose which division you want to give orders to. Once you've chosen, the Division Order menu pops up, and this one has four choices. REGIMENT ORDER lets you select the regiment (within that division) you will be commanding. If you choose SUPPORT you can allocate aircraft support points to that regiment. You have only a certain number of air points to work with, so you must decide how many each regiment will receive. DIVISION ASSETS allows you to assign unattached battalions to specific regiments. Finally, with MOVE HQ you can place your headquarters in a specific location. Supply and leadership flow through the HQ, so its placement is critical.

Most menus lead to further menus. The REGIMENT ORDER menu, for instance, brings up a menu allowing you to select which regiment you will give orders to. Once you've chosen, the Regiment Action menu appears, with four possibilities: ENGAGED, CONTACT, READY, and OB. OB (Order of Battle) is for checking the status of each battalion within the regiment, and is only an information menu. When you choose READY, another menu appears. Here you can place the regiment in RESERVE, command it to move towards an OBJECTIVE, order it to head for and engage the nearest ENEMY BATTALION, or DEPLOY into better formation. Most of these, of course, lead to a further menu.

If you choose CONTACT instead of READY, the Contact Action menu appears. Here the choices are RESERVE, DEFEND, SUPPORT, or PROBE. RESERVE places the regiment in waiting status, while DEFEND commands the regiment to find the best defensive terrain and formations. A regiment ordered to SUPPORT has its battalions coming to the support of a battalion under attack. PROBE launches a limited attack at the enemy.

Choosing ENGAGED activates the Engaged Action menu, from which you select RESERVE, DEFEND, DELAY, or ATTACK. The first two are the same as above. DELAY orders the regiment to pull back towards the headquarters unit, and is used when an orderly retreat is called for. ATTACK brings up the Attack Action menu, which allows the regiment to PROBE the enemy position, PREPARE for a later assault, ASSAULT the position, or EXPLOIT in an attempt to move through the position.

The game allows almost no chance of issuing an unwanted order. First, each menu has a default command that most benefits the unit, in case you simply forget about it. Second, you cannot access all the menus if your troops are not in position for a particular order. Finally, you can return to any menu, at any point during the turn, and change your mind. The only exception to this is the very first screen, which shows the command RUN 5. Once this is selected, the turn is in progress, and the orders cannot be changed. But even RUN 5 is accessible only once you've done something in the turn, so choosing it by accident is nearly impossible.

The four scenarios re-create four critical battles of the war: Crete (1941), Stalingrad (1942), Saipan (1944), and Bastogne (1944). Each is playable in at most two evenings (usually less), and you can play either the Axis or the Allied commander. Once you play out the strategic options of these scenarios, you can create your own. Like all SSG games, *Battlefront* contains a scenario construction program that allows you to design a scenario from scratch. If you want someone to do your research and design for you, SSG's magazine, *Run 5*, publishes full scenarios, along with commentary on the games and on the history behind them.

If there is a problem with *Battlefront*, it's with the amount of work the computer must handle. In several of the games I've played, regiments get mixed and jumbled almost of their own free will, and at times orders seem simply ignored. Perhaps this is a problem with the philosophy of the game itself: So much is left to the computer that, unless the computer portion of the game does its job extremely well, the player stands to be frustrated. For example, I expect my computer subordinates to keep the regiments together better than I can; that's their job. And I don't expect, as has happened, my headquarters unit to follow its march orders right into an enemy armored battalion. Experienced players have enough to do simply getting around their lack of total control. They do not need the frustration of hav-

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ing the computer do things incorrectly.

Whenever I examine a computer war game, I ask two main questions: Will an experienced war gamer like it?; and Will a beginner be able to play it? Often, one yes precludes the other, because experienced war gamers often enjoy a complexity that a beginner finds simply bewildering. In the case of *Battlefront*, however, I can suggest that both groups will like it equally well. The experienced gamer will appreciate the strategic options and realistic point of view, while the beginner will enjoy the menu-driven ease of play. In my opinion, *Battlefront* is the most enjoyable SSG war game to date, and that's saying a great deal.

—Neil Randall

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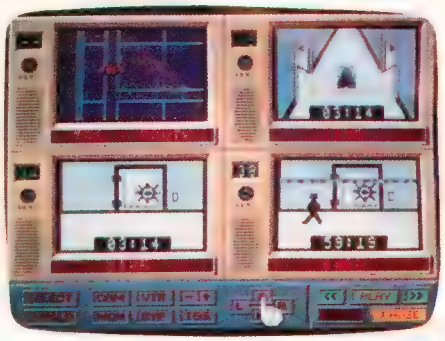
Hacker II: The Doomsday Papers



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Washington, D.C.

So begins your adventure into *Hacker II: The Doomsday Papers*, Activision's sequel to *Hacker*, last year's adventure hit. I found *Hacker* to be one of the most creative and unique games to come along for the 64, or for any other computer, for that matter. The concept of stumbling into an evil organization's computer network was intriguing, and saving the world from destruction, a challenge. The program was first-rate from start to finish. *Hacker II: The Doomsday Papers* not only delivers the same high quality of *Hacker*, but presents the *Hacker* veteran with an even more difficult challenge than was faced in the original.

As in *Hacker*, the game begins as though you are telecommunicating on your computer via modem. In *Hacker II*, you've signed on to a large information network when suddenly the message above breaks in on the transmission. From there you're told of a plot by a Soviet scientist and political strategist to overthrow the U.S. government. The "Doomsday Papers" documents his evil plan and is held in several vaults located in a secret Soviet military installation hidden deep in Siberia. The C.I.A. has managed to plant three mobile remote units (the same little robots found in *Hacker*, where they were known as the subterranean remote units) inside the facility and have patched into the installation's video security system. With the use of a "Multifunction Switching Matrix" (or MFSM) and the mobile remote units, you must make your way through the installation without being detected, and collect all the pieces of the document.

The MFSM is basically a souped-up VCR with four monitor screens that can be controlled remotely by satellite. From the four screens on the MFSM, you can see what any of the installation's numerous security cameras are viewing, tape what the cameras are seeing, and play your tapes back. With the MFSM you can see where the guards are and where they are going, and you can guide your mobile remote units through the facility's halls. Spying through the security cameras' eyes, you can locate the vaults holding parts of the Doomsday Papers, and the MFSM allows you to communicate with and control the mobile remote units.

Unlike *Hacker*, *Hacker II* does come with documentation. However, don't get your hopes up too high. The only documentation you're supplied with is a manual explaining the operation of the MFSM. The manual reminds me of those great specification manuals that supposedly were for *Star Trek*'s Enterprise. It's written in a detailed fashion, as though the MFSM really existed and you were handling a real MFSM on your mission. This is a nice touch that

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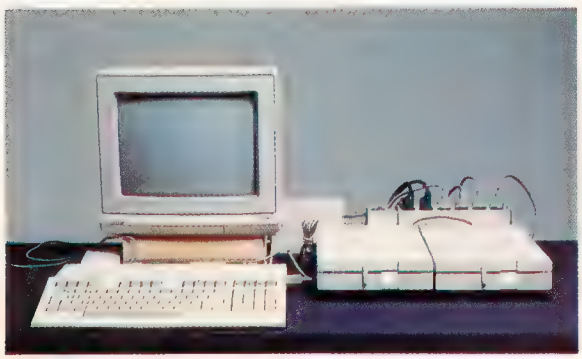

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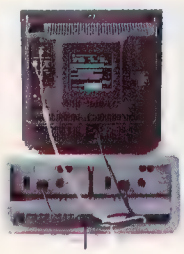

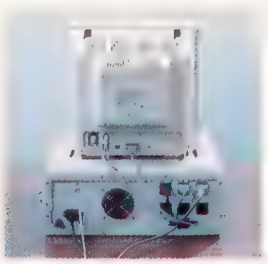

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helps propel you further into the spy fantasy. While indispensable, the manual doesn't outright tell you how to successfully perform your mission. Careful review of the manual and mastery of the MFSM's capabilities is the only way to enable you to plan a successful course for your mission.

All the action is seen through the four screens of the MFSM. The graphics are good, with details that sometimes will surprise you. Guards move through the facility on their rounds, and you can witness the movement of your mobile remote units. Beware, however, for once your mobile remote units are detected by either the guards or the security cameras, the "annihilator" will be dispatched. The annihilator is an unrelenting mechanical monster, and once a mobile remote unit is captured, the annihilator proceeds to turn the little robot into a pancake.

Hacker II is a great buy and will supply you with hours of fun. While a joystick is needed to run the program, *Hacker II* is not an arcade game. Rather, it's a fairly involved strategy game that will take some time to master. It will challenge and entertain beyond your expectations.

—Scott Thomas

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Gettysburg: The Turning Point

Most historians agree that the turning point of the Civil War occurred on farm fields south of a sleepy little Pennsylvania town called Gettysburg near the Pennsylvania/Maryland border. During three hot July days in 1863, the 82,000-man Army of the Potomac, under General George Meade, met the 75,000 troops of the Confederate army, commanded by General Robert E. Lee. After the battle, both sides had suffered horrible losses, and the Confederate army had begun a long retreat into Virginia. *Gettysburg: The Turning Point* puts you in the position of Lee or Meade at this crucial point in U.S. history.

I liked SSI's earlier *Battle of Antietam*, another excellent Civil War simulation (see the June 1986 issue), but *Gettysburg: The Turning Point* is even better.

As with most of SSI's simulations, you may choose to play against a human opponent or face your computer as adversary. And you may select to command the Union forces or replace General Lee. The multiple choices available in setting up the game from an easy-to-follow menu screen allow tailoring the game as you prefer. Set the variable factors any way you like, favoring one side or the other, or play a historically accurate simulation.

The Battle of Gettysburg lasted for three days. Playing the Campaign Game portion of this simulation may take you even longer. One complete game we played lasted nearly 60 hours. SSI says that the campaign game can take more than 40 hours. Playing out the shorter scenarios, one day in the battle takes more than eight hours. Don't expect to spend a couple of hours in the evening with this one; set aside an entire weekend. Fortunately, you do have the option of saving the game after each combat phase.

You can play scenarios based on the first, second, or third day of the battle. As each scenario begins, the opposing forces are in their historical positions. Will you order General George Pickett to attack Cemetery Ridge, the center of the Union line, with barely 15,000 troops? Maybe attacking the flank of the Union forces would be a better move. Would you like to try some other strategy in an attempt to press to a victory? Here's a chance to test your skill as a military tactician.

You'll find the game interaction to be very realistic. Order your units of artillery, cavalry, and infantry into position. Units can and often will run out of ammunition. Supplies are late in arriving. Press your men too hard and fatigue becomes a factor. And the casualty list continues to grow. You'll have to deal with many of the same problems that the famous generals encountered. Can you give the order to hold a position, knowing that the cost will be many lives?

If you've played SSI's *Battle of Antietam*, you'll find the game play of *Gettysburg* quite similar. Several small changes have been made in this new game, but the changes greatly enhance the playability of the simulation and are not very apparent; you have to look for them.

Players new to strategy war games will enjoy the ease of play at the beginner's level. All units are shown as icons, graphic representations of the forces on the board, and the decisions necessary to play aren't overwhelming.

As your skill increases, you can move on to the intermediate and advanced games, which offer maximum control of the forces involved. At these levels of complexity, it's usually best to switch from icons to the traditional war game symbols. You'll be controlling every aspect of your forces, and assume a greater degree of responsibility for their fate.

Most importantly, *Gettysburg* isn't a mindless "shoot 'em up." Hasty actions here can be costly. Attacking may not always be the best strategy. Sometimes it's best to hold your fire and conserve ammunition. As you learn the game, you'll probably feel the desire to learn more about the Battle of Gettysburg. It would be interesting to play out the historical battle, step by step, with just a few minor changes. Would the results be different?

A trip to your local library or bookstore to pick up a history book about the battle is definitely in order. Here's a chance for a parent or teacher to help bring an important part of American history to life for a student.

You're sure to enjoy many hours with *Gettysburg: The Turning Point*—it's a must for every war gamer's software library.

—George Miller

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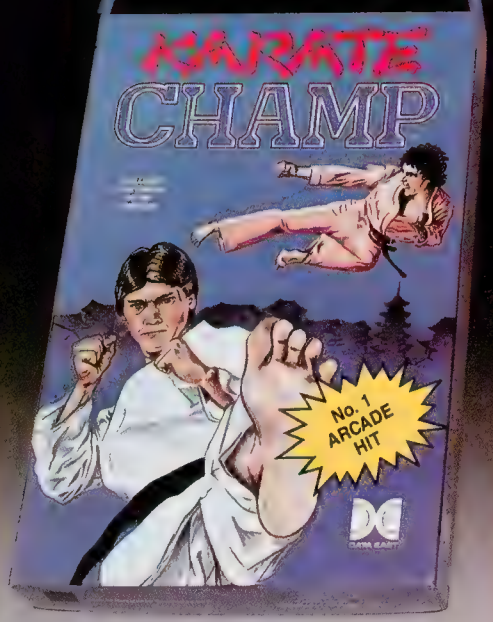

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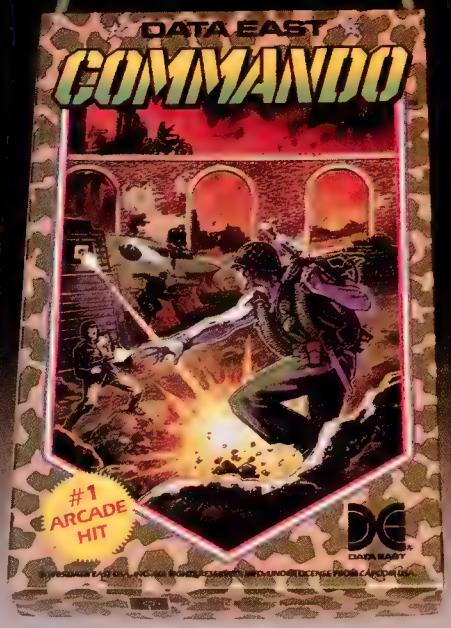

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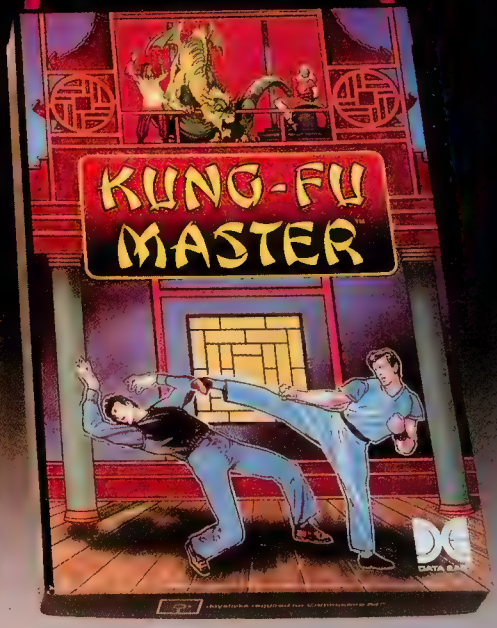

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Superscript 128

As with its kissing cousin *Superbase 128* (reviewed in the November issue), *Superscript 128* packs more power than most of us will ever need. On the other hand, many of us would rather drive a 400-cubic-inch V-8 than a little four-cylinder economy car, even if we never went farther from home than the corner market. So it is with *Superscript 128*: Use it for notes and memos as you will; when you're ready to write a five-pound romance novel or do a mass mailing to the Tom Cruise fan clubs, *Superscript* will fairly roar with power.

In using *Superscript* for the first time, you'll be pleased to note that the disk boots automatically (from the 1571 drive) and that the display is an 80-column green-on-black. You're prompted to make a working disk, and although subsequent uses still require you to boot with the master disk, this procedure lessens the likelihood of irreversible damage.

The first menu allows you to select from a list of compatible printers. This information is written to the working disk and displayed each time you boot up, providing for an automatic configuration.

Once you've done this, you're presented with a screen that's 80 columns by 22 lines of work space. The top two lines are for menus reminiscent of those found in *Lotus 1-2-3*: As you move the cursor to highlight options, a brief description of that option appears on the line below; select one and the line changes to show sub-options, each with its own description.

Although this is designed to help newer users to get the feel of the features, the menu system is as slow as any process you've ever seen—leaving you to wonder if you should have opted for a hammer, chisel, and a flat stone. As an example, the usually simple act of creating a heading requires that you meander through four menus before you're able to type the heading. But you still have margins and spacing to set—and to do this you must backtrack to the proper root menu and take the proper fork to arrive at the place where you can set margins.

Fortunately, a good number of the many options likely to be used during the writing process are accessible through Control Commands that utilize the Control key and a letter key. These allow such routines as appending a block of text, deleting words, turning Insert on or off, and going to beginning or end of text, as well as all the other cursor movements that involve moving more than a space at a time. Life will be easier and your enjoyment of *Superscript 128* greater if you learn these commands quickly. To help you, the documentation includes a quick-reference page that shows not only the Control Commands but also the tree structure of menus and submenus. In addition, the disk contains numerous help screens. Things may slow down, but you won't get lost.

When you format a document from the menus, as described above, the result of your menu journey is that the program produces a "dot command" and enters it in the proper place on the work screen. You can speed up this process by writing your own dot commands such as ".lm10 .rm10 .tm6 .bm6"—this example giving you left and right margins of ten spaces each and top and bottom margins of six lines each.

The document preview function will allow you to view your work at any time, with dot commands and paragraph markers removed, showing it exactly as it will appear on printout.

As with most good word processors, *Superscript* supports a variety of type styles for adding emphasis or creating headings. (How well these work for you will depend upon the printer you're using.) Among these are underlining, boldface, shadow, superscript, and subscript. Although they will not appear that way in your preview, emphasized words will be highlighted.

For those letters to members of the Tom Cruise Fan Club, *Superscript 128* allows a mail-merge function in which you create one letter (with markers) for everyone. The markers designate spaces where you wish information stored with *Superbase* to be inserted. This can be as simple as inserting a name and address at the top of each letter, or as finely tuned as referring to the recipient by name or title in the body of the letter (providing of course that the title is a part of the information stored in your *Superbase* records).

As well as supporting these variable markers, *Superscript* also allows for the use of "conditional variables," which simply means that if there is no information available for that slot (no title, for instance) the text will close up and not leave an embarrassing blank.

For addressing the envelopes, *Superscript* contains a labels document. Though small, this is a merge document which performs just as your letter did, pulling names and addresses out of your *Superbase* file and printing them in the form of mailing labels.

If you find you must sometimes present figures in your work, *Superscript* allows the use of numeric tabs that will keep your columns in proper alignment and also will perform addition of the numbers entered.

With all this power going for it, you may find that the spell-check feature is a bit different from others you may have encountered. To begin with, the flip side of the master disk contains two dictionaries, one British and one American (*Superscript* is a British import). So if you insist on spelling it *colour* instead of *color*, you're covered. Each dictionary is then divided into two parts, the Master and the User. New words added by you should go only to the user dictionary.

When invoked, the checker first lists the number of words in your document and the number of unique words, then prompts you to insert your copy of the dictionary disk. Here's where things get a bit strange: Words not spelled correctly are highlighted, and a menu bar gives you options of Accept, Edit, Learn, Ignore, and Quit. Accept allows temporary (throughout the document) use of the word, while Learn adds it to the user dictionary and Ignore passes over it until the next occurrence.

Edit does nothing more than allow you to correct the spelling by hand. It does not present a list of possible spellings, so if you're dealing with something more than a typo you're going to have to find a dictionary and look it up. There is a certain amount of frustration here: You know that it knows the correct spelling—how else could it know you were wrong?—but it isn't telling.

You may, however, jump out of the spell-check mode, return to the main menu, go through two more selections, and arrive at Search. Here, you type in the word (it can be shortened, using * as a wildcard) and the program will search the dictionary for a match. Then return to Edit mode and type it in.

My regrets about the complexity of the menus, and the intransigence of the spell-checker aside, *Superscript 128* still comes through as a powerful and full-featured word processor, with documentation geared toward the beginner and step-by-step guidance through the creation of documents as well as the use of math and mail-merge features.

—Ervin Bobo

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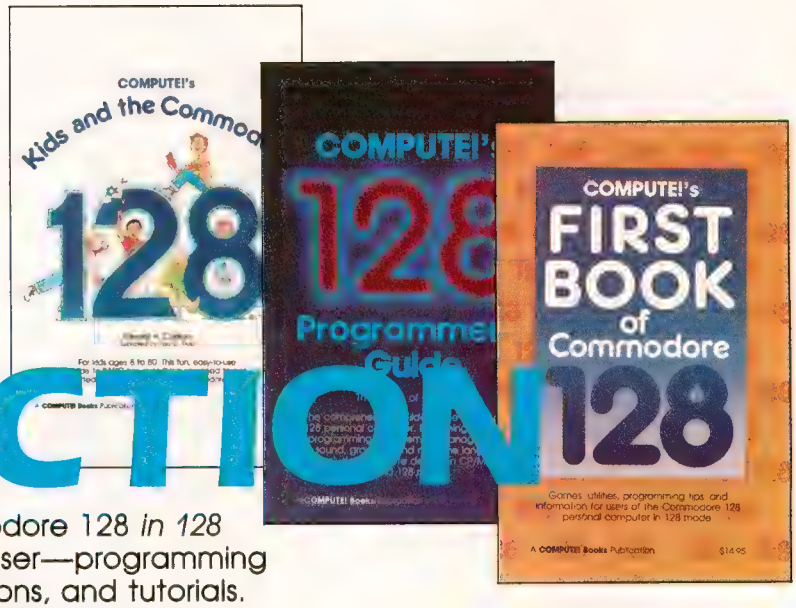

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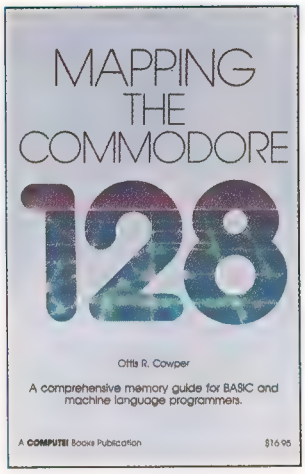

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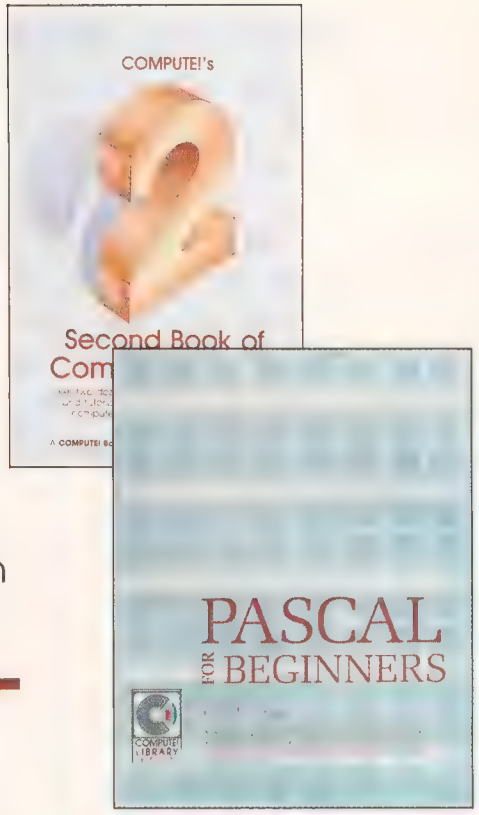

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machine language for beginners

A Simple Magic

Richard Mansfield
Senior Editor

You've seen them: mysterious lists of numbers in DATA statements within a BASIC program which are simply POKEd into memory. Finally, the program SYS's to the first number. And magic happens.

It looks like this:

```
10 FOR I = 49152 TO 49163
20 READ BYTE
30 POKE I,BYTE
40 NEXT I
50 DATA 160,0,185,0,4,153,0,5,136,208,
   247,96
60 SYS 49152
```

Try typing this in and running it (128 owners should use 64 mode).

The general structure of these strange BASIC programs is always the same. There's that loop which reads in the data and POKEs it. There's the SYS. Sometimes the SYS has a different address and, always, the DATA numbers are different, but this structure can be found in many BASIC programs.

The DATA numbers are a small machine language (ML) program. Unlike BASIC, ML isn't made up of words which are interpreted for the computer. It is, rather, comprised of numbers which the computer understands directly.

Slapping The Screen

Some of the numbers above represent actions for the computer to take: 165 means to load the following byte (the 0) into the Y register. And the 96 at the end instructs the computer to leave its native machine mode and return the familiar BASIC environment. A 96 is like a RETURN command in BASIC.

If you run this program, you'll see that it grabs the first 256 characters on your screen and slaps them down six lines lower. It happens instantly because ML runs so very fast. Any delay you notice is caused by BASIC trying to READ and POKE prior to the SYS (where the machine language takes over control of the computer). But if you then write or list something onscreen and directly SYS, you'll see the true speed.

How did the programmer know that these numbers, strung together in this particular order, would result in the little memory move that we can watch onscreen? (A similar routine is used in commercial software to move help screens from memory into screen RAM.) To write ML, do you need to memorize that 96 means RETURN?

Fortunately, no. ML is sometimes called assembly language because it's written using an *assembler*. We published an assembler in the October issue, and there are several available from software companies. With an assembler, you write instructions much the same way as you would write a BASIC program. The instructions are different, though. Each is three letters long and is an abbreviation. RTS, for example, means ReTurn from Subroutine and is used just like BASIC's RETURN command. So, using an assembler, you would type RTS to end an ML program, and the assembler would look up the meaning of RTS and insert a 96 to replace the word RTS.

It works this same way with all 56 of the ML commands. Here is what you would type into an assembler to create the example program above:

```
10 *= 49152
20 .O
30 LDY #0
40 LOOP LDA 1024,Y
50 STA 1280,Y: DEY
60 BNE LOOP
70 RTS
```

As you can see, some assemblers allow you to enter ML as if it were a BASIC program. You can use the excellent, built-in Commodore screen editor, line numbers, colons between commands, and even any utilities you would normally use in BASIC, such as automatic line renumbering. Some assemblers, unfortunately, require that you use their special editor, which not only means you need to learn a whole new set of word processing commands, but also forces you to abandon all the utilities you like to use when developing a program.

A BASIC Example

So, ultimately, ML is a matter of learning the ML set of commands and the special features of assembling. For example, the first line of every ML program must specify where in memory you wish the resulting ML program stored. That *= symbol in line 10 accomplishes this for you. Then, the .O tells the assembler to actually store the ML program in RAM memory (it's optional; you could, for example, store to disk instead if you wanted your final program to reside where BASIC programs normally sit).

Then, the program proper. Notice the label LOOP in lines 40 and 60. The better assemblers allow you to define locations within a program with ordinary words. You can then, in line 60, BNE (Branch if Not Equal to zero) back to the location of LOOP. By the way, the command preceding the BNE is the one which determines whether you go back to LOOP or continue on down the program. The DEY lowers the Y register by one each time through the loop. Finally, Y will hit zero, the branching will no longer take place, and the computer will RTS to end the program.

This program, though small, illustrates most of the elements of ML programming: loading and storing registers, looping, branching, and incrementing/decrementing. ML uses three general-purpose variables, called registers: the X, Y,

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and A registers. The A register is used most often to fetch and store bytes; X and Y are often used as counters to determine how often something happens in a loop or to index where something is being accessed in memory. In our example program, the Y register is set to zero (LDY #0) and then is used both to count down through the loop (DEY) as well as point to positions on screen RAM (LDA 1024,Y and STA 1280,Y). With these last two commands, we are involving both the A and Y registers. LDA 1024 means LoaD the A register with whatever byte (or screen character, in this case) is located at address 1024. But, by adding the ,Y to this command, we are telling the computer to load the byte at 1024 plus the current value in the Y register. Thus, we can quickly cycle through 256 characters because we DEY each time through the loop.

For a fuller understanding of the meaning of this ML program, here's how it would look translated into BASIC, line for line:

```
10 START = 49152
20 REM NO EQUIVALENT, BASIC
   ALWAYS STORES ITS PROGRAMS
   INTO RAM
30 Y = 0
40 A = PEEK 1024+Y:REM PLACE-
   NAMES LIKE LOOP NOT ALLOWED
   IN BASIC
50 POKE 1280+Y,A: Y = Y - 1
60 IF Y < -255 THEN Y = 0: GOTO 40
70 RETURN
```

Of course, we've followed the ML structure here. You'd construct a BASIC program differently, using BASIC's looping construction with FOR/NEXT. But it's worthwhile comparing the ML and BASIC versions to get a feel for the way ML handles variables, loops, and branches—the fundamental tools of computing, no matter what language is involved.

By the way, the reason ML can check for a zero after 256 DEY's is that when you decrement an individual byte, it continues counting down until it reaches zero, then it resets to 255 and counts down again. So, after we first stored that zero into the Y register, it hit a DEY and turned into the number 255, which, when tested by the BNE, was not yet zero. We continue the loop until, after 256 times through, Y finally contains a zero and we're done.

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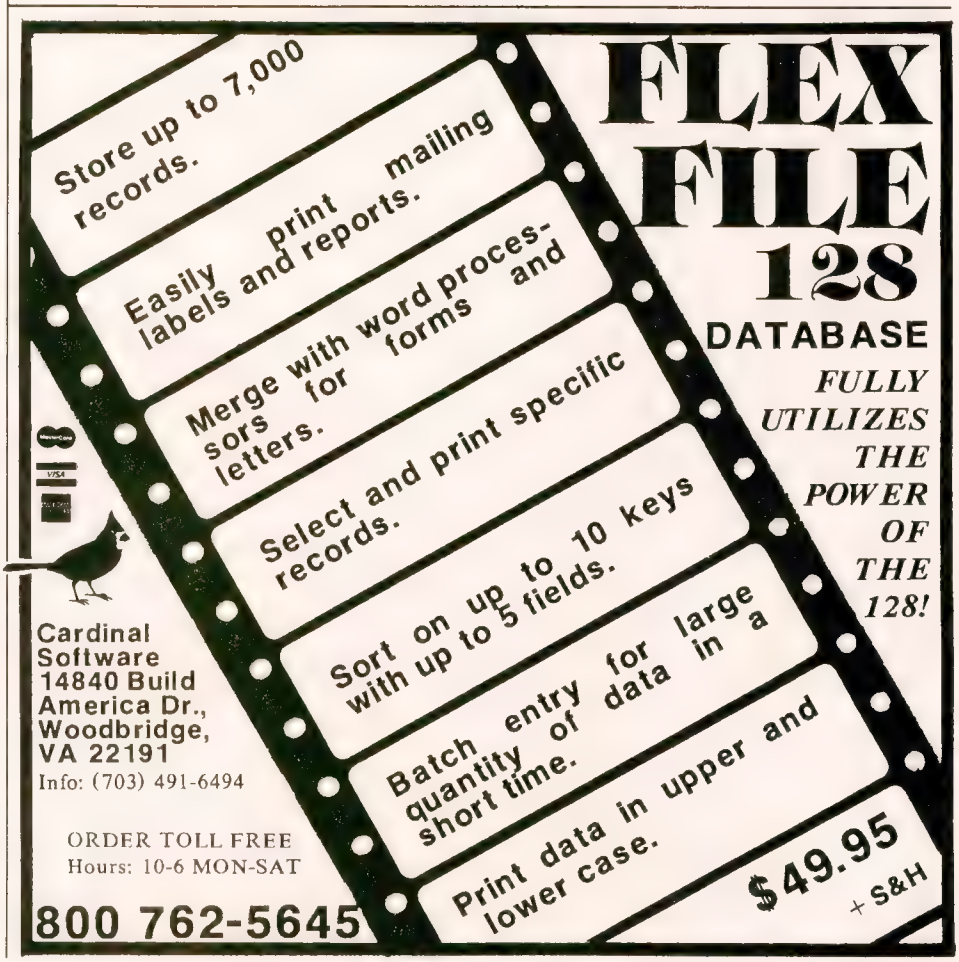
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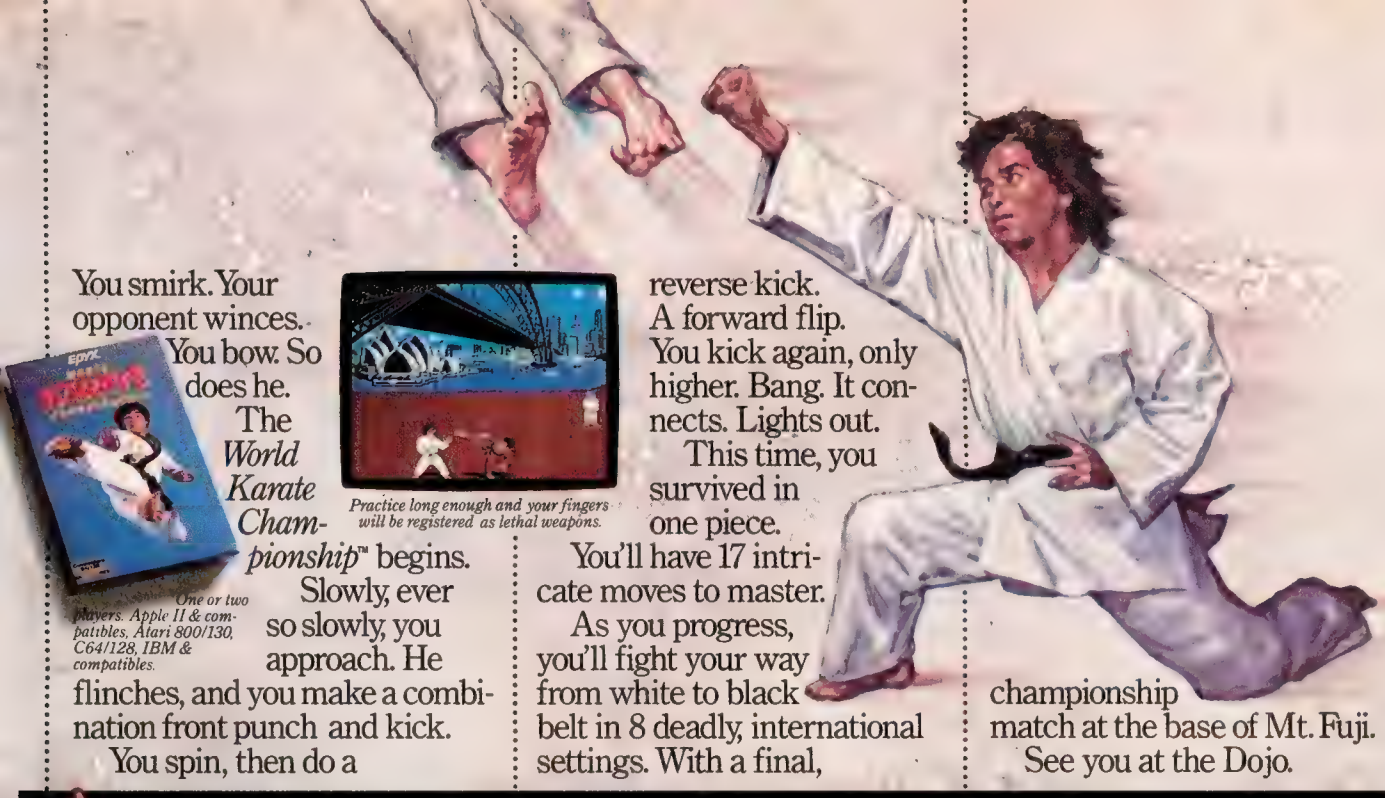

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Video Setup

Part 2

Jim Butterfield, Associate Editor

Last month, we looked at a program that provides Commodore 64 users with all the information needed to set up custom graphics screens. In this installment, we examine the Commodore 128 version.

When you want to create a special video screen, the arithmetic can get difficult, and there are pitfalls that may be hard to see. "Video Setup 128" helps you with the necessary calculations.

In the case of the 128, there's both good news and bad news. The machine is very helpful with some things, but it hinders you on others.

Here's the good news: You can put video almost anywhere in the 128. Whether you want standard characters, custom characters, or high-resolution graphics, you may select either RAM bank (0 or 1) and any 16K block within the bank for video. If you want a split screen, you can get it just by asking for it.

Here's the bad news (but it's not that bad): The standard printing and graphics commands all assume that the VIC video memory area will be in bank 0, at addresses 0–16383. If you want to use any other block, you'll need to rely on POKEs to get data to the screen. Depending on your objectives, that may be no problem.

The regular 128 screen may be good enough for many applications. But if you want to build your own character set or do some hi-res work, you might need a custom screen or two.

Video Setup 128 won't do all the work for you, of course. Character-set or sprite construction is up to you; the program just shows you how to allocate the areas concerned. If you want a split screen, the program does quite a lot for you, making sure the various areas don't conflict. For other uses of dual screens, however, you'll need to run Video Setup 128 twice, once for each screen. You'll then have two sets of POKEs to switch in each screen.

Running the Program

Before we start experimenting, type in and save a copy of Video Setup 128. Then load it and type RUN. You're first asked about the type of screen you'd like to set up. Do you want a split screen or not? If you opt for a split-screen setup, you'll be asked in two sections about each of the screens. If you respond that you don't want a split screen, you'll be asked to select whether you want text or a hi-res screen. In this case, the program asks for information on the option you have selected.

All the data for your custom screen—screen memory, character set, and sprites—must reside within a single 16K block of a specific bank of RAM memory. You may opt for the standard character set in any block, in which case you'll later be given the POKE to bring the character ROM into the viewing area of the video chip. If you don't want standard characters, you'll eventually be given the POKE to make this ROM invisible to video so that it doesn't clutter up the available memory space.

If you're creating a text screen and have decided on a custom character set, you'll be asked to choose a site for it; this site is known as the *character base.* Keep in mind that the computer allocates enough space for 256 characters to be defined; if you don't need that many, you don't have to use the entire memory area for characters. If you've specified that you want the regular character set, the computer knows where to find it and won't ask.

If you're doing a hi-res screen, you'll be asked for the screen area. That, too, is the character base, but it's used in a different way.

For a text screen, you'll be asked to pick a location for screen memory, more properly called the *video matrix.* You're offered safe addresses—those not used by other video elements. In hi-res, you'll be asked for the color memory (once again—the video matrix).

If you've chosen a split-screen display, the program gives you an interim summary and then asks you for details on the other part of the split, followed by a second summary. If the screen is not split, the computer gives you the whole story at once. Either way, you'll get a summary of the areas used, and the

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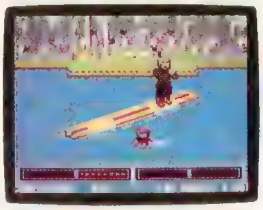

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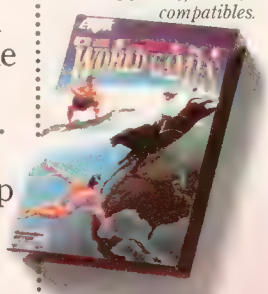

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POKEs needed to create them. And you'll get a cautionary note telling you where BASIC (bank 0) or variables (bank 1) normally reside so that you can avoid conflict.

Sprite information is also supplied if you ask for it.

A First Run-Through

Let's look through the program and use it to set up something trivial—the 128's normal screen. At first, this may seem silly—we already have this screen. But if we work through the numbers, we'll get the POKEs that will help us to get back to this configuration whenever we wish.

Enter responses as follows: No split screen; Option 1 (characters). We'll select bank 0 and memory area 0 (addresses 0–16383), and answer NO to custom character set. Finally, video matrix is 1 (screen memory is normally at 1024–2047).

Now get out your pencil to make some notes, and you'll see:

```
BANK 0
VIDEO MATRIX: 1024 TO 2047
(SPRITE POINTERS AT 2040 TO 2047)

POKE 54534,4
POKE 56576,7
POKE 2604,20
POKE 216,0
POKE 217,0
```

The POKE commands are shown with comments on their purpose.

After you've noted this data, press a key to continue, and then respond YES to the sprites question, and you'll see that there are three areas in which sprite drawings can be placed.

Note the caution, which states that BASIC normally occupies memory that we might choose to use for sprites; in this case, there's no conflict with the video matrix. You could choose to relocate the BASIC work area; that would involve changing a pointer at addresses 45 and 46 and typing NEW, but that's outside the scope of Video Setup.

We don't need to perform any of these POKEs right now, since our 128 is already set to these values. But we'll keep them handy.

A Working Example

Let's try for something fancy—a split screen in bank 1 of memory. Remember: PRINT and graphics commands don't work in this area, so we'll need to use POKEs for any work we want to do.

We'll choose area 1 in bank 1. Run Video Setup, and type these responses: YES to split screen, and bank 1, area 1. For the character screen, type NO to build a custom character set. Select video matrix (the text screen memory) at block 2 (addresses 18432–19455). Note that we aren't offered blocks 4, 5, 6, and 7; that's where the character-generator ROM will be.

Now comes the first part of our POKE sequence. We have:

```
BANK 1
VIDEO MATRIX: 18432 TO 19455
(SPRITE POINTERS AT 19448 TO 19455)

POKE 54534,68
POKE 56576,6
POKE 2604,36
```

Write these down, and note that they all differ from the standard screen POKEs we performed earlier. Press any key to continue and enter NO to multicolor.

At this point, the computer recognizes that there's only one place that the hi-res screen can fit in, so it doesn't ask you where to place it.

The next question is an eye-opener. You're given a choice of locations for the color memory (video matrix). This time, we're offered blocks 4–7, which were not allowed to us before. How can this be?

When a split screen is enabled, the character-generator ROM is switched in and out as required. It's there when we're writing text; it's gone when we're drawing pictures, so we may use that part of memory for hi-res if we wish.

Good. We'll prove it can be done by selecting number 7. Now we can complete our list of POKE commands:

```
BANK 1
VIDEO MATRIX: 23552 TO 24575
(SPRITE POINTERS AT 24568 TO 24575)
CHARACTER BASE: 24576 TO 32767

POKE 2605,120
POKE 216,96
POKE 217,0
```

These POKEs complete the set of commands. The last POKE shown—the one to 217—is the same as that for the normal 128 screen. We won't need to use it, since we're not changing anything in this case.

If we ask for sprite information, we find that we can put sprite definitions in two areas. Then we are cautioned about the variable area, which normally runs from 1024 to 65279.

This last bit of information is important. We don't want variables to run over our screen areas. We should take steps to insure that this doesn't happen by changing the start-of-variables pointer (at addresses 47 and 48), moving its contents up so that it points above the area we're using; or the end-of-variables pointer (at addresses 57–58), moving it down until it's below the area we're using.

In case something goes wrong, we'll build in a TRAP statement to bring the screen back:

```
90 TRAP 300
```

Now let's move to our new split screen:

```
100 BANK 15
110 POKE 54534,68
120 POKE 56576,6
130 POKE 2604,36
140 POKE 2605,120
150 POKE 216,96
```

By this time, our screen will be switched. Now we'll POKE something there so we can see it working. We'll do characters, hi-res colors, and then hi-res detail:

```
200 BANK 1
210 FOR J=18432 TO 19455:POKE
    J,46:NEXT J
220 FOR J=23552 TO 24575:POKE
    J,1:NEXT J
230 FOR J=24576 TO 32767:POKE
    J,7:NEXT J
```

And then we'll do them again to watch the change:

```
240 FOR J=18432 TO 19455:POKE
    J,24:NEXT J
250 FOR J=23552 TO 24575:POKE
    J,86:NEXT J
260 FOR J=24576 TO 32767:POKE
    J,96:NEXT J
```

And finally, we'll put everything back:

```
300 BANK 15
310 POKE 54534,4
320 POKE 56576,7
330 POKE 2604,20
340 POKE 216,0
350 TRAP
```

Note that we didn't need a POKE 2605 when we returned, since that's a graphic-mode POKE.

Memory Tour

Let's take a quick tour of 128 memory to identify the areas that might be a bit tricky when you're doing video work.

• "Window Wizard" (September) works as listed, but there is one error in the article. On page 63, in the description of the !RESTORE command, it is incorrectly stated that PEEK(37635) will tell you which screen is currently being pointed to. The correct address for the PEEK is 49155, not 37635.

• As listed, "Directory Extension" (October) doesn't save file descriptions correctly. The problem is caused by a misspelled IF statement in line 530. Since BASIC ignores spaces, the misspelling causes BASIC to create a new array, FS$, which is automatically dimensioned to 11 elements. When the index of the array is incremented beyond the last element, BASIC prints BAD SUBSCRIPT ERROR LINE 530. To correct the problem, enter line 530 as follows:

```
KB 530 PRINT CHR$(34)"...":FOR
       R=1 TO C: IF S$(R)=""
       {SPACE}THEN S$(R)="
       {RVS} "
```

• The Plus/4 and 16 versions of "Polar Art" (November) fell victim to a bug in our lister program. The lister interprets the character π (pi) as a SHIFT–up-arrow, but on the Plus/4 and 16, the up-arrow itself is a SHIFTed character. The correct way to type pi on a Plus/4 or 16 is to hold down the Commodore key and press the = key. Line 10 should look like this:

```
AQ 10 F=2*{=}:XS=160:YS=100:SF
      =.73:BC=0:CC=1
```

• Several readers have had problems getting "Math Worksheet" (July) to work with their Commodore 1526 or MPS-802 printers or with any printer which turns off double-width mode after each carriage return. In the article, the author mentions that changes must be made to lines 560, 570, 590, 600, and 610, but the changes are not discussed; these are listed below. Remember, if your printer uses a code other than CHR$(14) to turn on double-width printing, you need to make the appropriate changes. Also note that a companion program, "Division Worksheet," is scheduled for an upcoming issue.

```
SJ 560 PRINT#4,CHR$(14);"
       {13 SPACES}MATH WORKSHE
       ET":PRINT#4,:PRINT#4,
JR 570 PRINT#4,CHR$(14);"NAME
       {30 @}":PRINT#4
QS 590 PRINT#4,CHR$(14);:FOR J
       =I TO 9+I:PRINT#4,"
       {2 SPACES}";LEFT$(A$(P%
       (J)),1)" ";:NEXT J
QE 595 PRINT#4,CR$;CHR$(14);
XE 610 PRINT#4,CR$;CHR$(14);:F
       OR J=I TO 9+I:PRINT#4,"
       {2 SPACES}{T} ";:NEXT J
```

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The first 1024 locations—from 0 to 1023—are sensitive and important (in *all* banks). The operating system needs this area, so leave it alone. Similarly, don't use memory above address 65279 in any bank.

Bank 0, address range 1024–2047, is where the video matrix (screen memory) is normally located. Locations 2047–7167 contain general work areas, much of which may be used for video (check a memory map for details). From 7168 to 65279 we find the area used for the BASIC program. When you write a BASIC program, you may want know where it ends, so check the contents of the pointer at 4624–4625. You're free to use any higher addresses (you'll usually have plenty of space).

An alternative for bank 0 is to use the command GRAPHIC followed by any number from 1 to 4. A command of GRAPHIC 0 returns you to a text screen, but now BASIC programs are moved up so that they start at address 16384. This liberates addresses 7168–16383 for graphics work—in fact, that's exactly why the GRAPHIC command shifts BASIC's starting location.

In bank 1, address range 1024–65279, we find the area used for BASIC's working values (variables, arrays, and strings). Variables and arrays are stored from the lower end going upward; strings are stored from the top down. This means that there is no truly safe place in bank 1 unless you reset one of the pointers. Either set the start-of-variables pointer higher (with POKEs to 47 and 48) or set the limit-of-variables pointer lower (with POKEs to 57 and 58). As you recall, we took a chance on our simple demonstration program; but if you're writing a serious program, do it right.

No matter which bank or area you pick, you'll be able to call the character ROM into play if you want standard characters, or kick it out if you don't. And you can use split screens; the only limitation is that everything must fit into one bank and a single 16K area.

Video Setup 128 is handy for screen arithmetic. It can give you insight into the workings of 128 video, and can help you with a wide variety of video-oriented tasks.

See program listing on page 110.

One-Touch Function Keys

Keith Ashcraft

This utility programs the 64's function keys for a variety of useful tasks. And best of all, it provides a menu of its functions on the top screen line. A disk drive is required.

The Commodore 64's function keys are a highly useful feature. Because they're programmable, they can be tailored to the needs of any user. "One-Touch Function Keys" adds four functions—including a directory listing—to your 64. And you don't have to worry about forgetting which key does what; they're always listed at the top of the screen.

Because the program is written entirely in machine language, it must be typed in using "MLX," the machine language entry program found elsewhere in this issue. Be sure to read and understand the instructions for using MLX before you begin typing in the program. When you run MLX, you'll be asked to provide starting and ending addresses for the data you'll be entering. The correct values are:

Starting address: C000
Ending address: C11F

After you finish typing in the program, be sure to save a copy before leaving MLX. To load One-Touch Function Keys, use a statement of the form LOAD "*filename*",8,1. (Substitute ,1,1 for the ,8,1 if you're using tape instead of disk.) Type **SYS 49152** to activate it. You should see the definition line on the top of the screen.

Here's a list of the functions that One-Touch Function Keys adds to the 64:

- **f1**—The Directory
  Press f1 at any time for a directory listing. RUN/STOP halts the listing.
- **f3**—List
  The BASIC program currently in memory is listed when f3 is pressed.
- **f5**—Save
  Press f5 for SAVE to be printed on the screen.
- **f7**—Load
  Press f7 for LOAD to be printed on the screen.

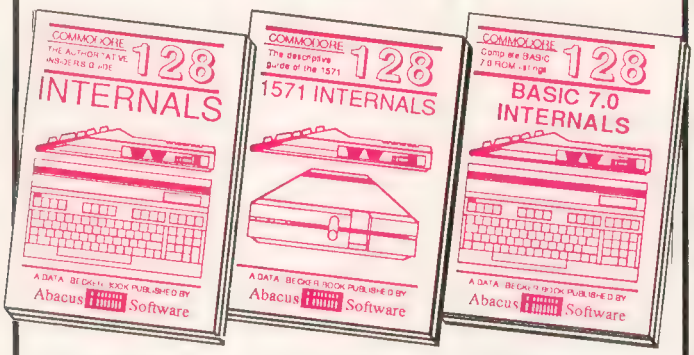
When you use Load or Save (f5 and f7), you must insert the filename of the program and press RETURN. For example, if you wanted to load a file named GAME.OBJ, you would press f7 and then "GAME.OBJ",8,1.

RUN/STOP–RESTORE disables the program, but typing SYS 49152 reactivates it. Try to avoid using One-Touch Function Keys with other programs that use the RAM area at 49152.

See program listings on page 110.

BOOKS

that stand on their own



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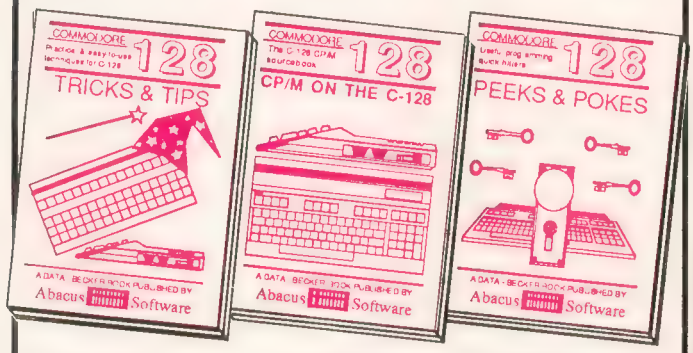

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Icon Changer For GEOS

Douglas S. Curtis

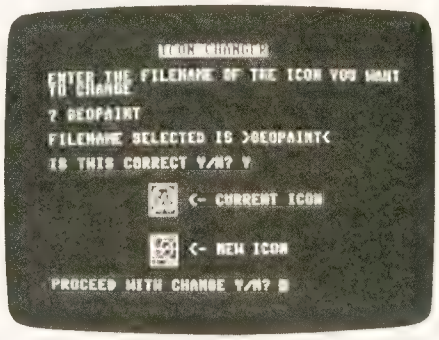
Change the appearance of GEOS icons with this powerful utility. You can use the new icon designs included in the program or design your own. For the 64 with GEOS.

GEOS, the new and powerful operating system for the 64, uses graphic symbols called *icons* to represent various program operations and disk functions. "Icon Changer For GEOS" lets you easily redesign these icons.

Typing It In

The program is written in BASIC. After turning on your 64, type it in, and save a copy (do not load *GEOS* into memory). When you've done this, load Icon Changer. Now place a *GEOS* work disk (*not* the *GEOS* system disk) into the drive. Type RUN. The program asks for a filename. Type in the name of the file whose icon you wish to change. The icon is read off the disk, displayed, and labeled CURRENT ICON. The DATA statements in the program are labeled NEW ICON. You now choose whether or not to make the change. Type N to keep the current *GEOS* icon or Y to replace it with the new one. Finally, you're asked if you want to change any other icons to the same pattern. Type Y or N.

The sample icon redefinitions I've included with the program are stored in the program beginning at line 1000. Icons used by *GEOS* are in standard sprite format. If you wish to design your own, a sprite editor like "Sprite Magic" (August 1984 GAZETTE) can generate the DATA statements for you. If you don't have a sprite editor, you must design the sprite on paper (see "Sprite Graph" in last month's issue) and supply the DATA statements yourself. I've included five new icon patterns in the DATA statements found at the end of the program listing. The program uses only one set of DATA statements at a time (the REM statements delimit the sets), so you must delete all the lines containing DATA statements before the icon definition that you want to use before running the program. One note of caution: Don't try to change the icon of a standard Commodore 64 file (which is clearly indicated on a *GEOS* Desktop menu). The data for it is stored internally in the *GEOS* Desktop program.


ENTER THE FILENAME OF THE ICON YOU WANT TO CHANGE
? GEOPAINT
FILENAME SELECTED IS >GEOPAINT<
IS THIS CORRECT Y/N? Y
<- CURRENT ICON
<- NEW ICON
PROCEED WITH CHANGE Y/N? N

"Icon Changer" lets you tailor the look of GEOS *Desktop.*

GEOS File Structure

The data for the *GEOS* icons is stored on the disk. The problem in my initial investigation was finding exactly where. An examination of the disk revealed much about the file structure of *GEOS*. Using the program on the 1541 *Test/Demo* disk, I made a track/sector printout of a directory block (see Figure 1). The result showed that *GEOS* disks are somewhat different from standard ones. Bytes 0 and 1 of the block still point to the next block to read. The next byte (number 2) is still used to indicate the type of file. The next two bytes (numbers 3 and 4) show the first change from standard format. They now point to the VLIR (Variable Length Indexed Record) blocks. (VLIR blocks are an integral part of the *GEOS* system.) They are filled with the track/sector pointers for the *GEOS* application files, which is why the standard disk validate command will not work on a *GEOS* disk. The next 16 bytes are used to store the filename, just as on a standard disk. After the filename, the file structure changes again, and the next two bytes, 21–22 ($15–$16), are the track/sector pointer for the icon data. (This block also contains the file INFO: file descriptors, addresses, and comments.) The icon data is stored in the standard sprite format (3 × 21 bytes) from bytes 5–67 ($05–$43). (See Figure 2.)

See program listing on page 114.

Figure 1

```
TRACK 18  SECTOR 1

ØØ :12 Ø9 C3 Ø5 Ø7 44 45 53 4B 2Ø 54 4F 5Ø AØ AØ AØ :
1Ø :AØ AØ AØ AØ AØ Ø5 14 Ø1 Ø4 56 Ø3 Ø7 ØF ØØ 47 ØØ :
```

Figure 2

```
TRACK 5  SECTOR 2Ø

ØØ :ØØ FF Ø3 15 BF FF FF FF 92 49 Ø1 FF FF Ø1 8Ø ØØ :
1Ø :1D BF FF DD AØ ØØ 5D BF FF C1 AØ ØØ 5D AØ ØØ 55 :
2Ø :AØ ØØ 5D AØ ØØ 41 AØ ØØ 41 B8 ØØ 41 A8 ØØ 41 BF :
3Ø :FF C1 8Ø ØØ 1D 8Ø Ø1 D5 8Ø Ø1 D5 8Ø ØØ 1D 8Ø ØØ :
4Ø :Ø1 FF FF FF C3 Ø4 Ø1 Ø6 Ø4 Ø5 Ø4 Ø6 Ø4 44 65 73 :
```

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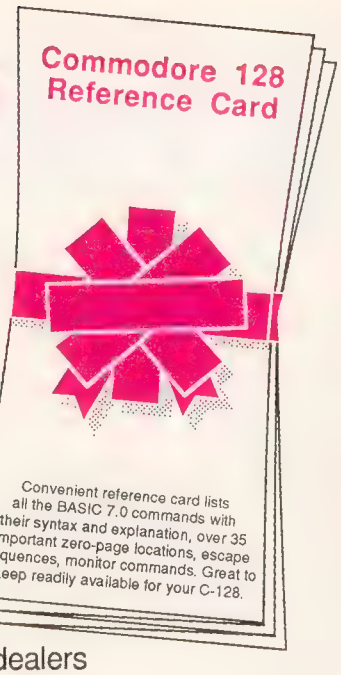
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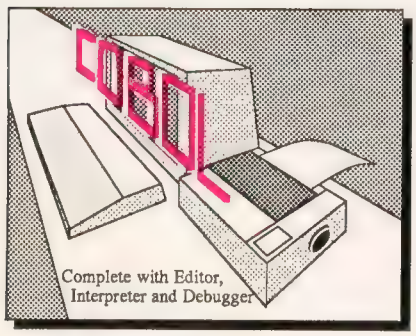

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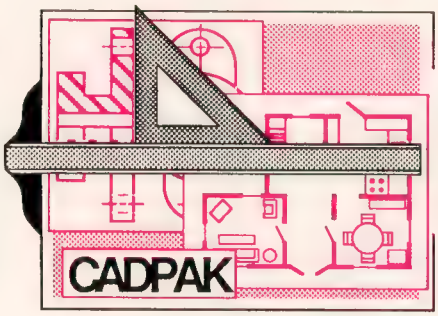

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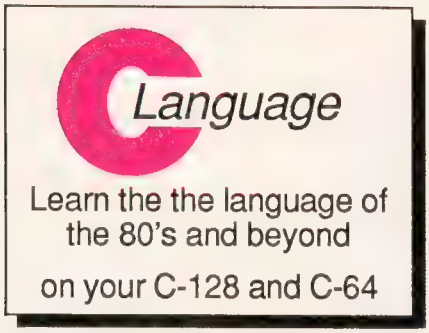

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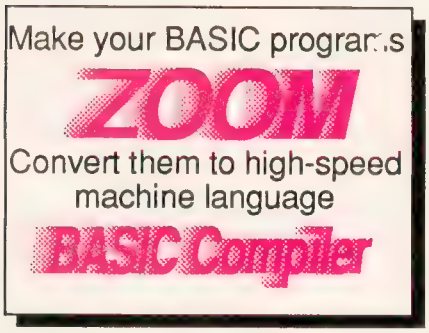

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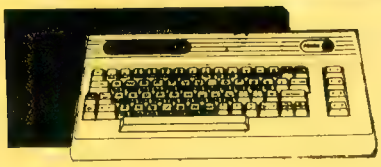

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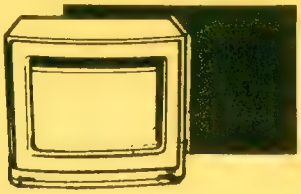

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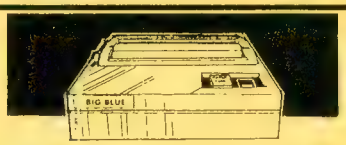

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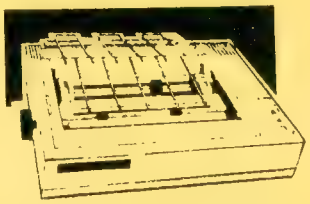

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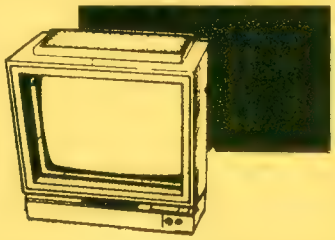

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Medium-Resolution Graphics For The 64

Louis Giglio

This program adds a brand new graphics mode to your 64: medium resolution. Use a simple command to plot points in 16 colors on an 80 × 50 grid. You can mix text with graphics, as well.

Sometimes you just don't need all the detail that the high-resolution bitmapped screen affords. On the other hand, the resolution of the text screen is very low—40 × 25. Often, a compromise between the two would be ideal. A medium-resolution screen would require less memory than a hi-res screen and offer more detail than a character screen.

Program 1, "Medium Resolution 64," uses standard Commodore graphics characters to provide an alternative 80 × 50 medium-resolution multicolor screen. This format is useful for games and other programs that require simple graphics.

Medium Resolution 64 is written entirely in machine language, so you must use "MLX," the machine language entry program found elsewhere in this issue, to type it in. After loading and running MLX, you'll be asked for starting and ending addresses for the data you'll be entering. For Medium Resolution 64, respond with the following:

Starting address: **C738**
Ending address: **C927**

After you've finished typing in all the data, be sure to save a copy to tape or disk before exiting from MLX. To use Medium Resolution 64, type:

LOAD *"filename"*,8,1

Replace the 8 with a 1 if you're using tape rather than disk. After the program has finished loading, type:

NEW

The NEW command is mandatory—it resets some important BASIC pointers.

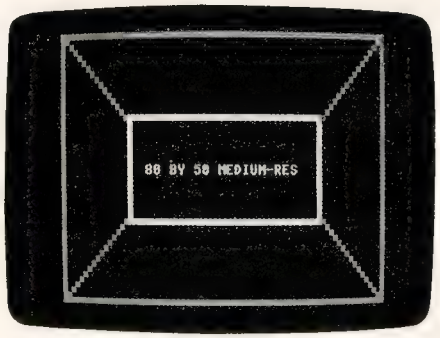
Plotting And Printing

Medium Resolution 64 can plot individual points on the normal character screen. Use the command:

SYS 51000,X,Y,C

X and Y are the horizontal and vertical screen coordinates, respectively. The X values may range from 0 to 79 and the Y values from 0 to 49. If you try numbers outside this range an error will occur. The values of X and Y, however, do not have to be integers; fractional values will be rounded. C determines the color of the pixel. Use the standard color values (0–15).

Since Medium Resolution 64 uses the normal character screen, setting the color of one pixel will also set the color of the three neighboring pixels that share the character cell (remember, color memory has 40 × 25 resolution), so you may have to experiment a bit to get the effect you want.



This screen, one of several from "Medium Resolution Demo" (Program 2), shows how text is easily combined with colorful graphics on an 80 × 50 screen.

The normal character screen is used, so you may still use PRINT and POKE to display characters on the screen in the usual way.

Program 2 is a short demonstration program written in BASIC. Before you load and run Program 2, be sure that the machine language for Medium Resolution 64 is already in memory (and that you've typed NEW).

Many machine language programs use the 4K block of memory located at 49152–53247 ($C000–$CFFF). Medium Resolution 64 occupies locations 51000–51492, leaving free space above and below itself. Therefore, it remains compatible with many machine language utilities, including the DOS Wedge. *See program listings on page 109.*

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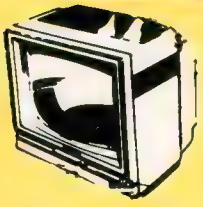

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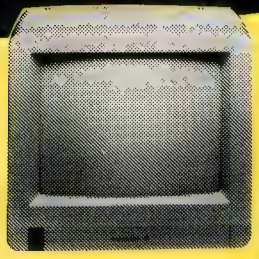

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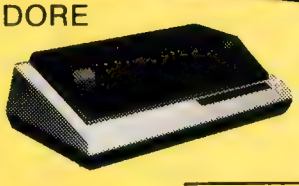

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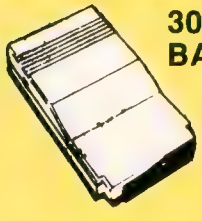

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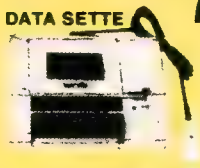

JOY STICKS

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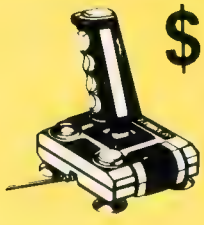

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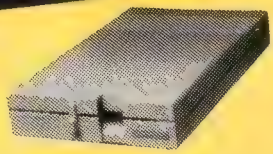

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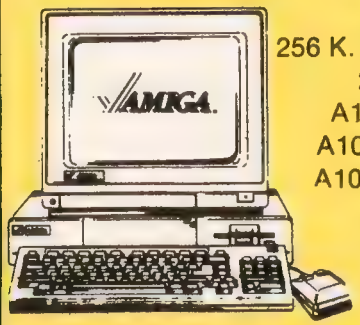

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Data-Aid

Henry Pesch

This clever program is helpful when you're working with DATA statements. It adds several new commands that come in handy for programming or typing in data. Although the program is written entirely in machine language, you do not have to know machine language to use it. For the Commodore 64.

Reading numbers from DATA statements and POKEing them into memory is one of the most useful techniques available to programmers. DATA statements can contain sprite data, machine language routines, or sound parameters, for example. When you're working with DATA statements in your programs, "Data-Aid" can help in a variety of ways.

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New, Helpful Commands

Data-Aid is a machine language program that occupies 1K of memory beginning at location 49152. Type it in with "MLX," the machine language entry program found elsewhere in this issue. After loading and running MLX, you'll be asked for a starting address and an ending address for the data you'll be entering. Answer the prompts with the following values:

Starting address: **C000**
Ending address: **C407**

After you've saved a copy, load the program with LOAD"*filename*",8,1 (LOAD"*filename*",1,1 for tape users). Type NEW; then start Data-Aid with SYS 49152. The screen turns green and this message appears:

```
DATA-AID ACTIVATED
```

Several commands have now been added to BASIC.

The exclamation mark (!) serves as a flag for Data-Aid. When the computer sees it, it knows it must interpret the next letter as a Data-Aid command. Let's look at each of the available commands.

!R—Restore. This sets the DATA pointers to a specified program line. The next READ will get the first item of the chosen line. This is similar to BASIC 7.0's RESTORE *line number* command.

The following example shows how to use !R:

```
10 DATA HARRY,BILL,JACK
20 DATA MARY,LIZ,ANN
30 DATA 20,23,19
40 !R 20:READ A$:!R 10:READ B$:
50 L=30:!R L:READ N
60 PRINT A$;B$;N
RUN
MARYHARRY 20

READY
```

As you can see, !R works with any numeric expression, even a variable. !R can also be used in direct mode.

!S—Speed POKE. Transfers numbers from DATA statements to memory very quickly. !S 100,5000 reads byte data (decimal integers in the range 0–255) beginning at line 100 and POKEs them into memory beginning at location 5000. The process ends when a negative number is read. This method is four times faster than the following commonly used technique:

```
10 READ A:IF A<0 THEN RETURN
20 POKE M,A:M=M+1:GOTO 10
```

!S can be used within a program or from direct mode. Use this technique only when your DATA consists of numbers between 0 and 255. Remember to use a negative number as the last item of the DATA block—it isn't POKEd into memory; it's used to mark the end of the data.

!D—Create BASIC DATA lines from memory. Use this when you already have a machine language routine (or sprite data) in memory, and you want to generate DATA statements from RAM. For example:

```
!D 64,1000,49151
```

writes 64 lines (16 numbers each) of DATA statements. The first line generated is numbered 1001, and the first

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—John Dvorak, San Francisco Examiner

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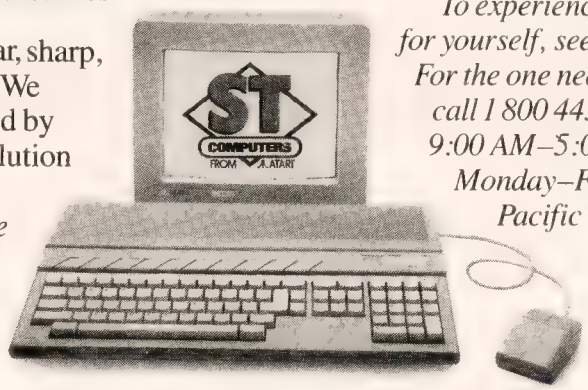

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memory location PEEKed is 49152. Since DATA statements use up to four times more memory than the byte data, make sure you have plenty of memory free when using this command. If an OUT OF MEMORY ERROR occurs, the computer must be turned off and back on. The format of the command is !D *N,L,M*. This command writes *N* BASIC lines of DATA statements beginning at line number *L*+1 and including byte data beginning at location *M*+1. !D can also be used inside a program (but after execution you'll be in BASIC's direct mode).

!M—Magnify DATA. This command enlarges the screen display of DATA items one by one. It's useful when even your most determined efforts at finding typing mistakes fail. !M 150 displays the first DATA items on line 150 in the middle of your screen magnified to four times the size of a standard character. Press RETURN to magnify the next item in sequence. The line number is also displayed (after the first line). Common mistakes to look for are: O instead of 0, l instead of 1, missing commas or periods instead of commas, and transpositions like typing *125* instead of *215*. !M is most useful with byte data. With string data, only the last three characters are displayed.

!C—Change colors. This makes it easy to change the screen colors to find the most comfortable combination. For instance, if you want to change the border color to red, screen color to yellow, and print color to black, !C 2,7,0 does the job. The format of the statement is: !C *border,screen,print*. !C works in both program and direct mode.

!B—Beep. !B G5 plays a note G in octave 5. Notes may be C. D, E, F, G, A, or B, and octaves range from 0 to 7. This command works in both program and direct mode.

!Z—Disables Data-Aid. Be sure you use this command before you load anything else into locations 49152–50175, where Data-Aid is resident. Data-Aid redirects the vector to the IGONE routine, BASIC's routine to execute statements. If you don't use the !Z command to restore the original vector address, the computer will crash when you execute the next BASIC statement.

See program listings on page 115.

CP/M: Surviving With 40 Columns

Ken Arbuckle

CP/M was designed to be used with 80-column monitors. If you have a 40-column monitor, the tips in this article will help you manage. For the Commodore 128 with 1571 disk drive.

If you've tried to use the CP/M operating system that came with your 128, you've probably discovered that nearly all CP/M programs are written to work with an 80-column screen. The 128's 40-column solution to this problem is to let you look at a "virtual" 80-column screen 40 columns at a time. CONTROL-← and CONTROL-→ are used to move a 40-column window over the 80-column screen. This can be disorienting and tedious—ten keypresses are required to get from one side of the screen to the other. The ideal solution, of course, is an 80-column monitor like the 1902. But if you've got a composite 40-column monitor, there are ways to live (at least temporarily) with a 40-column window.

The Printer (CTRL-P)

One thing you can do is echo work to the printer. CONTROL-P sends (nearly) everything to the printer as well as to the screen. A second CONTROL-P turns the printer off. Most printers normally print in 80 columns, and a printed copy can be a great help when you're starting out. However, echoing to the printer slows everything down drastically. You may soon grow impatient with it.

The DEVICE Command

You can shorten some of the 80-column screen displays by changing the screen-display parameters. This can be done with the DEVICE command. Try this: List the directory (by typing DIR or pressing F3) of your CP/M disk. The screen display is 80 columns wide. Now (after the system prompt *A*>) type DEVICE CONSOLE [COLUMNS=35] and press RETURN. Do another DIR (or F3). Everything should appear on the first 35 columns of the screen. Unfortunately this doesn't always work—some programs still insist on filling the entire 80-column display (the HELP program is one example). Use DEVICE CONSOLE [COLUMNS=80] to go back to 80-column mode.

A Better Scroll

The 80-column displays would be easier to deal with if scrolling capabilities were improved. You can use the KEYFIG.COM program (found on the CP/M system disk) to help do this. Since you'll be making changes to your disk, you should be working with a copy of the CP/M system disk, not the original. If you aren't, use the FORMAT.COM program to format a blank disk and the PIP.COM program to copy your

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original CP/M disk to the new disk (A>pip e:=a:*.*). When this is done, work from your copy and proceed.

Run the program (command file) named KEYFIG by typing KEYFIG at a system *A>* prompt. Press RETURN, and CP/M will load and start this program. To the first query, *Do you want help?*, answer *n*. The rest of the program is menu-driven. Use the 128 cursor-up and cursor-down keys (the ones on the top row of your keyboard) and the RETURN key to make your choices. Then simply work through the menus, making the following selections:

1. Source of definitions: CP/M boot disk.
2. Edit a key definition.
3. When the editing display for *no key* shows on the screen, press F1. The display should change to show the four values for F1. Choose the option to change the *normal* value.
4. Choose the *assign a string* option.
5. Choose string 11 (*SCREEN LEFT> <SCREENLEFT> <SC*).
6. Choose the *Exit string edit—save assigned string* option. The display should change to show that the string *SCREEN LEFT> <SCREEN LEFT> <SC* is now assigned to the F1 key.
7. Press the F7 key. The display changes to show the four values for F7. Choose the option to change the *normal* value.
8. Choose the *assign a string* option.
9. Pick string 12 (*SCREEN RIGHT> <SCREEN RIGHT> <SC*).
10. Choose the *Exit string edit—save assigned string* option.
11. Select the *Done editing—exit and save work file* option.
12. Choose the option to save your work file *as CURRENT definitions.*

Before we go further, let's check and make sure this worked.

To the question *Do you want to do anything else?*, reply *n*. Now reply to the system *A>* prompt with DIR (or simply press F3). You'll get a directory listing—in 80 columns. Press F7—your screen window should move 20 spaces to the right. Another F7 should take you to the end of the 80 columns. Press F1 twice—you should be back at the far left side of the screen. It sure beats scrolling four spaces at a time.

A Permanent Change

If you're happy with that, let's make it permanent. Ask for KEYFIG again. When it starts, choose to work from CURRENT definitions. On the next menu, choose the *Exit and save your work file* option and select *on CP/M boot disk* as the place where you want your definitions saved. You should see the reply *Saving your new definitions to CPM+.SYS Disk.* You may now exit the program (by answering *n* to the question *Do you want to do anything else?*).

The changes you made should now be permanent. Whenever you boot up CP/M from this disk, the F1 and F7 keys scroll halfway across the screen with each keypress. Try it and make sure it works.

If you want to assign more keys, repeat the process. Use KEYFIG, work from the definitions on your CP/M boot disk, and make the < and > keys (shifted comma and shifted period) equal to string 11 and string 12. When you've finished, exit and save your work file as CURRENT. (Your changes don't take effect until you save them as part of your CURRENT system). Is everything working okay? If so, then get into KEYFIG again, work from your CURRENT definitions, and immediately exit and save your work file to the CP/M boot disk.

You've made the first step towards a customized CP/M. Any time you boot CP/M from this disk, you'll be able to scroll 20 columns at a time using either the < and > keys or F1 and F7. It's only a beginning, but it is the beginning of your own personalized operating system. If there are other changes you'd like to make, use KEYFIG to add them. If you make a mistake or find you aren't happy with what you've done, you can always erase all your changes by going back and starting over with the DEFAULT definitions.

It's a small change, but at least now you can read 80 columns on your 40-column monitors. And using the command DEVICE MONITOR [COLUMN=35] should keep any new files you create limited to a 40-column format.

computing for families

Beyond The Desktop: New Metaphors For Computers

Fred D'Ignazio
Associate Editor

The Macintosh mouse/windows/icons/pull-down-menus interface is rapidly spreading throughout the personal computer world. New computers like Commodore's Amiga, Atari's ST, and Apple's IIGS use it. With Microsoft's *Windows* program, a PC can look like a color Macintosh; and with Berkeley Softworks' *GEOS*, so can a 64. This interface is becoming universal, even in the diverse world of computer software. Computer games, word processors, database programs, and graphics programs are all taking on a Macintosh-like look.

The Macintosh interface replaces the abstract, text-oriented world of older computers with a more visual, real-world environment—the world of the *desktop*. Indeed, the desktop is the new look—the primary visual computer metaphor for our imagination. Software and hardware manufacturers ask us to imagine that when we use the computer, we are really using an electronic office, complete with file folders, a trash can, alarm clocks, memo pads, calculators, and, of course, the desktop.

This is a great step forward. We humans operate best in an environment that's similar to something we've already experienced in the real world. Real-world environments have a powerful sensory, even emotional, appeal. We are not, after all, pure intellect—organic computers. The things in life we find most appealing stimulate our feelings, our five senses, and our imagination.

Only A First Step

The metaphor of the desktop does this. But it's only a first step. The process of creating vivid, imaginative computer metaphors has just begun.

But does a file folder really turn you on? Does a trash can tickle your senses? Does a memo pad set fire to your imagination?

Probably not. And it was never supposed to. The desktop metaphor came from computer designers' image of computers as business tools, as information processors. We process information at desks, they reasoned, so why not make a computer simulate a desktop?

The computer as desktop is a valid, viable image. But it's only one image. It's time for us to search out new images that relate more to our senses, feelings, and imaginations. Let's free computers from the desktop mentality and open them up to non-desktop thinking and applications. This call to action especially applies to the millions of computer users for whom a desktop is a limited metaphor. I'm thinking of children, artists, musicians, media producers, teachers. I'm thinking of anyone not using the computer strictly for filing, analysis, or data processing applications.

Using new metaphors for human/computer interaction will make computers more appealing and easier to use. Even more important, if the metaphors are well chosen, they will enable us to use our senses, feelings, and the powerful pattern-recognition parts of our brain to manage computer-generated information. Our eyes, ears, and other senses are highly evolved information processors which filter, switch, screen, and route billions of bits of sensory data to different parts of our brain and nervous system every second. Our mind is particularly adept at generating patterns out of this mountain of sensory information. So why not use this ability in our interaction with computers?

We need to start asking ourselves, what is a good metaphor for young children who use a computer? What about elderly people? Handicapped people? Artists, musicians, and craftspeople? Teachers? Lawyers? Writers? Engineers? Biologists?

The Seagull "Finder"

I had a conversation with award-winning science-fiction writer Orson Scott Card a few years ago. We talked about new metaphors for computer operating systems and what would be appropriate for children.

Scott closed his eyes and dreamed of a child sitting at a computer. When she turned it on, a picture of a seagull flying high over a blue ocean appeared on the display screen. The seagull was (to use Macintosh terminology) the "finder." As the child flew her gull over the sea, little islands appeared with coral reefs, atolls, and palm trees. The islands were files. If the child wanted to access a file, she steered her seagull (via some pointing device—like a mouse or a finger) to the island.

This sort of imagery might sound inappropriate for today's files, which consist mainly of text and numbers. But it will not be out of place for tomorrow's files, which contain pictures, voices, music, charts, graphics, animations, and photographs.

A seagull soaring over emerald islands is just one image. I'd like to see you put your imagination to work and dream up what metaphors would be most appealing to you. When you sit down at your computer, what would you like to see on the screen? What images might work better for you than file folders, memo pads, and trash cans? Please send your metaphors to me, care of COMPUTE!'s GAZETTE, and I'll share them with everyone in a future column.

Todd Heimarck
Assistant Editor

This is the January issue, so a fair number of new computer owners are reading the GAZETTE for the first time. If you were lucky enough to get a Commodore 64 or 128 for Christmas, you may have already started to think about what software or hardware you'll buy next. But before you spend another penny on your computer system, consider joining a user group. You don't have to be a computer expert to join, although most groups do have a few experts who can answer questions from beginners.

User groups usually meet once a month. You might see a new program demonstrated, see a new piece of hardware, or hear a discussion of computer topics. You'll also meet other computer owners.

Public Domain Software

User groups have an abundance of public domain programs. Some programmers choose to give up their copyright and release a program into the public domain, which means that it can be freely distributed.

User groups become collection points for public domain software; some groups have hundreds or even thousands of programs in their libraries. What this means is that you can join a group and immediately have access to many free programs, some of which are gems.

Most groups charge a nominal fee per disk, partially to pay for the computer equipment, the cost of the disk, and the time spent to make copies. Even if you can't use 18 of the 20 programs on one disk, a dollar or two for a couple of good programs isn't a bad price. Many programs are written by the members themselves. Others come from trading with other user groups. Almost all user groups have a strict policy against making pirated copies of commercial software (some will expel you if you're ever caught making copies of such programs).

Another popular activity is the local bulletin board system (BBS). If you own a modem, you can call the BBS and leave messages, engage in games, discuss politics, or download public domain programs.

Education And Advice On Buying

If you're interested in learning to program, you may find a user group that offers classes in your area of interest, whether it's BASIC for beginners or advanced machine language techniques. Or there may be a special interest group (SIG) for a topic you want to investigate. Some SIGs get together to play adventure games; others have informal meetings about the 128, graphics, music, CP/M, COMAL, or almost any other subject.

Some groups have designated experts who have volunteered to help with specific programs. If you can't get *EasyScript* (a word processor) to underline, call the *EasyScript* expert, who might be able to give you the answer over the phone.

If you're thinking about buying a new printer or a database program, or just looking for a good game, you can get advice from members who have bought programs that they either love or hate.

Once you decide on a certain program, you may be able to use your membership in the user group to get a discount from a local store. Commodore dealers often offer lower prices to members of the local group. User groups sell disks, too. In lots of 1000, bulk disks can cost as little as 50–75 cents; user groups can buy a case of disks and pass the savings on to their members.

The Newsletter

In addition, you'll usually get a monthly newsletter. At the very least it will tell you what happened at last month's meeting and what's going on at the next meeting. Many user groups trade newsletters and give permission to reprint their articles to other groups, so it's possible that you'll see articles from around the country in your local newsletter.

Newsletters often contain new product reviews—you can read about hardware and software from the point of view of a user like yourself. Also, a review in a newsletter is often written by someone who shopped around and found the best price through a local dealer or mail-order house.

You may also find fiction, programming tutorials, interesting (and useful) POKEs, and humorous cartoons or satire. Some user group newsletters are quite entertaining.

A complete list of user groups is published yearly here in the GAZETTE; the next list will be published in a spring issue. If you can't find a group in your area of the country, you could start your own. All that's required is a group of people who are interested in learning about computers and sharing what they know.

Information Please

Rick Nash

This utility helps to unlock the mysteries of program and variable storage by providing you with a detailed analysis of how a program uses memory.

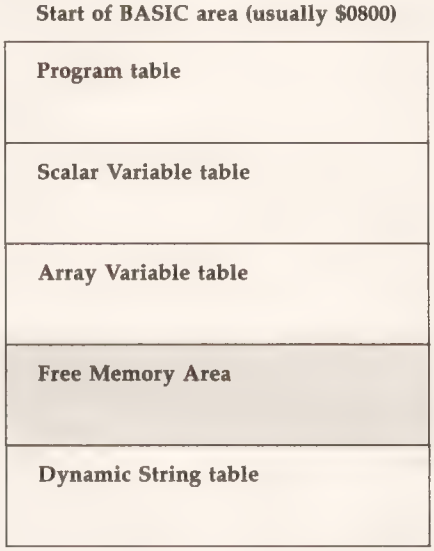
"Information Please" is a tool for BASIC programmers. It tells you exactly how your program uses memory. With this knowledge, you can learn more about how your 64 programs work, and how to make more efficient use of memory when you program. Here's a rundown of the information given by the program:

- number of program lines
- length of your program
- length of the variable table
- length of the array table
- length of the string table
- total amount of memory available for BASIC use
- total amount of memory required by your program
- amount of free memory (same as BASIC's FRE function)

In order for this information to be useful, it's important to be aware of how BASIC's tables work. Let's take a closer look at them. Four separate tables coexist within the approximately 39,000 bytes of memory available for BASIC program use. These tables are:

- The program table. This is where your BASIC program resides. As lines are entered, this table grows upward towards high memory.
- The variable table. As each new scalar (nonarray) variable is defined (as the program runs), an entry is made in this table. It grows upward.
- The array table. Like the scalar variables, array values are entered as a BASIC program runs. This table grows upward.
- The string table. Strings defined within the program area (such as 10 A$="HELLO") don't need to be stored in a table. When strings are constructed dynamically (as in the assignment C$ = A$ + D$), BASIC needs a separate table in which to store them. This is the string table. It starts at the highest available memory location and, unlike the preceding tables, stores information starting at the top and working downward.

BASIC Tables



After examining the structure of these tables (see the figure), you can easily understand why variables are cleared when a program line is inserted or deleted. The first three tables are directly adjacent to each other. When the program changes size, the variables become invalid. Since the values are no longer reliable, BASIC clears the variable, array, and string tables.

We can use our knowledge of the structure of the tables to help speed up our programs. Note the figure. Any addition to the variable table must push the array table higher in memory. Therefore, you can cut down on initialization time by defining all scalar variables before arrays.

Asking For Information

Information Please is a BASIC program that creates a machine language program and saves it to disk or tape. To use it, type in the program and save a copy. Since there are many DATA statements, which require accurate typing, use "The Automatic Proofreader," found elsewhere in this issue, to type it in. After saving a copy, run the program and choose whether you want the machine language to be saved to tape or disk. When the program finishes, a machine language program will have been saved to the device you specified.

Let's use Information Please to analyze a typical BASIC program. Type LOAD "INFO PLEASE",8,1 (tape users should type LOAD "INFO PLEASE",1,1), then NEW. Now type in the following program (but don't run it yet):

```
10 A=15:A$="FIFTEEN LETTERS"
20 A(1)=15
30 END
```

Now type SYS 49152 to enable Information Please. As you can see, it tells you about your program storage. Type RUN to execute your program. When it ends, type SYS 45192 again. The information is the same, except that BASIC has allocated storage for the scalar, string, and array variables.

Information Please must always be loaded before you load the BASIC program from which you want a report. Type SYS 49152 to execute it. Although you can call Information Please at any time, you must run your program first in order to see how much variable space it uses. Information Please uses memory locations 49152–49423 ($C000–C10F)—so don't use it in conjunction with programs designed for the same area.

See program listing on page 114.

BASIC for beginners

All About Loops

Larry Cotton

Before we get started this month, I'd like to talk about a weird Commodore BASIC phenomenon which you've probably seen on your computer: quote mode.

Quote mode can be pretty frustrating, even for experienced programmers. You know you're in it when you see reversed characters after you press the cursor keys, the insert key (SHIFT–INST/DEL), the color-change keys (CTRL or Commodore plus a number), or the function keys.

Let's force ourselves into quote mode and explore it a bit. Clear the screen and move the cursor to the center. Type a quote (a SHIFTed 2), then a few characters. Now press any of the cursor keys; SHIFT–INST/DEL; CTRL or Commodore plus a number; or a function key. You'll see a chain of reversed characters instead of what you expect. Quote mode remains in effect until you type a closing set of quotes or until you press RETURN to enter the current line.

There's also a slight variation on quote mode called insert mode: Move the cursor to the center of a clear screen and type any word. Back the cursor to the middle of the word and press SHIFT–INST/DEL to open up a few spaces. Now press one of the cursor keys. Instead of the cursor behaving normally, reversed characters pop into the spaces. The same is true of the function keys and CTRL- and Commodore-*number* combinations. Insert mode behaves like quote mode with these exceptions: Insert mode affects only the exact number of character positions you opened up by pressing SHIFT–INST/DEL; the insert key (SHIFT–INST/DEL) in not affected by insert mode (it continues to open up spaces, rather than showing a reversed character); and the delete key (INST/DEL without SHIFT) *is* affected by insert mode.

Now that you know what quote and insert modes look like, and what causes you to get into them, how do you get out on those occasions when you enter the mode accidentally? You could just press RETURN, but that would enter the line into memory. A better solution is to press SHIFT–RETURN. This terminates quote mode and puts the cursor at the beginning of the next line down *without* entering the line into memory. Move the cursor up to where you were and resume programming. Commodore 128 users have an even easier way out. They can cancel quote mode by pressing ESC O. (That means press and release the ESC key, and then press and release the O key. It won't work if you press the two keys simultaneously.) You can also use ESC ESC (just press ESC twice).

Looping With FOR-NEXT

Now let's go back to learning BASIC. The next statements on the agenda are FOR and NEXT, which together form FOR-NEXT loops. Few programs can be written without loops—check the BASIC listings at the end of this magazine for firsthand proof.

Seven items are mandatory in every FOR-NEXT loop. They are:

1. the word FOR
2. a counter (any valid numeric variable)
3. an equal sign
4. a starting value for the counter (any valid numeric expression)
5. the word TO
6. an ending value for the counter (any valid numeric expression)
7. the word NEXT

Here's a simple example program:

```
10 FOR X=1 TO 500
20 NEXT
```

The first six parts of a FOR-NEXT loop must be written together on the same line; the NEXT may be written on the same line (with a colon separating it from the FOR part of the loop) or on another line.

This do-nothing loop is actually very useful for delays, which suspend a program to, say, allow the user to read a message on the screen. This loop just kills time. The length of the delay can be changed by substituting another value in place of the 500. Larger numbers yield longer delays, and smaller numbers give shorter delays. And you can use any numeric variable you choose as the counter; it doesn't have to be X.

When you run the program, the computer first makes X equal to one. When NEXT is encountered, X is increased from 1 to 2, and the computer backtracks to the FOR statement. It continues looping, quite quickly, until X reaches 501; then you see the cursor again, indicating that the computer has finished executing the program.

Why does X wind up with a value of 501? And how do you know that it does? To answer the second question first, type PRINT X in immediate mode. *Aha.* X is 501. For another demonstration, type NEW; then try this program:

```
10 FOR Z=1 TO 100: PRINT Z: NEXT
20 PRINT: PRINT Z
```

This is not a delay loop. You're telling the computer to do a task (PRINT Z) before it reaches NEXT. When you run this program, the computer loops in line 10, printing a column of numbers in the range 1–100 on the screen. (This program takes much longer than our simple delay program because the computer takes some time to print the values of Z.)

When the NEXT is encountered the last time through the loop, Z is incremented to 101 and the computer scoots back to the FOR

once again. But this time, it discovers that the value of Z exceeds 100, and sends control of the program to the statement *right after* the NEXT—in this case, the PRINT statement in line 20, which prints a blank line and the value of Z again, which you see is 101.

Other Uses For FOR–NEXT

Any number of BASIC statements can be put between FOR and NEXT. To illustrate, try the INPUT statement, which was explored last month. Type NEW to erase our last program, and type this:

```
10 FOR Y=1 TO 4
20 INPUT A$
30 PRINT Y;A$
40 NEXT
50 PRINT "THAT'S ALL!"
```

This gives the computer two tasks between the FOR and the NEXT. In line 10, Y starts out as 1. An INPUT is asked for in line 20. The user types something (stored in the variable A$) and presses RETURN. Control goes to line 30, where Y and A$ are printed. (Remember that the semicolon causes Y and A$ to be printed together on the same line.) Line 40 increments Y to 2, and the computer scurries back to the FOR again, which it finds at line 10. The loop is repeated three more times, Y is incremented to 5, and control is sent to line 10 for the last time. This time, the computer sees that Y exceeds 4, and sends control past the NEXT to line 50, which prints the ending message.

By the way, the previous value in A$ is overwritten each time the computer loops, so that if you PRINT A$ after the program ends, you'll see only the last value that was INPUT.

Remember that when the FOR-NEXT loop has finished executing, the counting variable (Y in the case above) is always *one more* than the maximum value indicated in the loop.

One STEP At A Time

There are several other things you should know about FOR-NEXT loops. Suppose you want to increment the counter by an amount other than 1. No problem. BASIC provides for this case with another statement—STEP. Or suppose you want to start incrementing from some number other than 1—BASIC allows you to do this, too.

The next few short programs illustrate how to use STEP. You don't have to type in each one if you understand them. But if you do type them in, type NEW before entering the one that follows. The one-liner below illustrates both situations just mentioned.

```
10 FOR U=20 TO 40 STEP 2: PRINT U:
   NEXT
```

When you run it, the numbers 20–40 are printed in increments of 2, starting at 20. You can even make the counter count backwards. Just set its starting value larger than its ending value, and make the STEP value negative, like this:

```
10 FOR I=100 TO 80 STEP -2: PRINT I:
   NEXT
```

STEP can be almost any number—even a decimal—and you can make it and the starting and ending values variables. This short program illustrates all of these situations, with a loop from 1 to 3 in steps of .1. The spaces are used for clarity; they are not necessary.

```
10 A=1: B=3: C=0.1
20 FOR I = A TO B STEP C: PRINT I:
   NEXT
```

If you want to see something interesting, use 2 as the upper limit instead of the 3 that I used. The program only counts to 1.9—it never reaches 2. Why not? It has to do with the way that numbers are stored in the computer. We interact with BASIC in decimal (base 10) numbers, but internally the computer does its math with binary (base 2) numbers. Sometimes something is lost (or gained) in translation. Run the program again. Now PRINT I. The computer answers 2. Now PRINT I-2. The computer prints out a very small number. This means that the computer thinks that I is slightly over 2; that is why the loop ends prematurely. Be careful when you use decimals for STEP values.

A parting thought before leaving STEP: If you don't use the word STEP, the computer always increments the counter upwards by one.

Nested Loops

FOR-NEXT loops can be nested inside each other. There are many uses for this, as we'll see in future columns, but for this month, look at this simple case:

```
10 PRINT" I"," J"
20 PRINT
30 FOR I=1 TO 5
40 FOR J=1 TO 3
50 PRINT I,J
60 NEXT J
70 NEXT I
```

Notice how the variables I and J can—but don't have to—be used after the NEXT statement. This is one of the few things that are optional in BASIC, but using this option helps the programmer (and anyone who's trying to understand the program) to see the nested loops more clearly.

Run the program and leave the results on the screen for now. Lines 10 and 20 print the headings I and J and a blank line. Line 30 starts the first counter, I. Then the second counter, J, is started in line 40. It executes three PRINT loops before sending control to line 70, which increments I and sends control back to line 30. Since the J loop has finished a complete loop, it can be (and is) reset to 1. In fact, J counts from 1 to 3 five times, as you can see by the results on the screen.

Notice that nested FOR-NEXT loops work from the inside out; in the program above, the J loop is inside the I loop. This is shown more clearly if the program is compressed (or "crunched," as some computer people prefer) into two lines, like this:

```
10 PRINT" I"," J":PRINT
20 FOR I=1 TO 5: FOR J=1 TO 3:
   PRINT I,J: NEXT J: NEXT I
```

Here's a program which illustrates some of the principles we've learned over the last three months.

```
10 PRINT "{CLR}"
20 S$="  "
30 INPUT"CHARACTERS";C$
40 PRINT "{CLR}"
50 FOR T=1 TO 23: C$=S$+C$
60 PRINT C$
70 FOR D=1 TO 100
80 NEXT D
90 NEXT T
100 GOTO 100
```

When you run it, you're asked to type something—anything up to 16 characters long, SHIFTed or unSHIFTed, but not reversed.

I'll save the explanation of this program for next month. In the meantime, try to figure it out; there's nothing in it that hasn't been covered in the last three columns.

Next month we'll also look at IF/THEN, GOTO, and END. ■

How To Type In *COMPUTE!'s GAZETTE* Programs

Each month, COMPUTE!'s GAZETTE publishes programs for the Commodore 128, 64, Plus/4, 16, and VIC-20. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We frequently publish two programs designed to make typing easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then back on, erasing whatever was in memory. So be sure to *save a copy of your program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the GAZETTE, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT} and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↑	

For Commodore 64 Only

[1]	COMMODORE + 1	
[2]	COMMODORE + 2	
[3]	COMMODORE + 3	
[4]	COMMODORE + 4	
[5]	COMMODORE + 5	
[6]	COMMODORE + 6	
[7]	COMMODORE + 7	
[8]	COMMODORE + 8	

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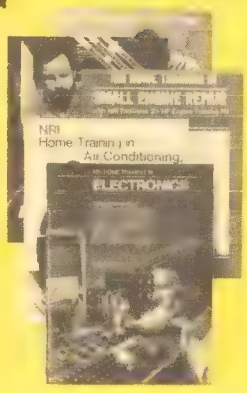

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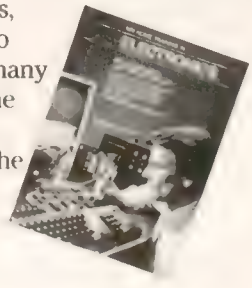

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The Automatic Proofreader

Philip I. Nelson, Assistant Editor

"The Automatic Proofreader" helps you type in program listings for the 128, 64, Plus/4, 16, and VIC-20 and prevents nearly every kind of typing mistake.

Type in the Proofreader *exactly* as listed. Since the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unfamiliar commands. After finishing, save a copy or two on disk or tape before running it. This is important because the Proofreader erases the BASIC portion of itself when you run it, leaving only the machine language portion in memory.

Next, type RUN and press RETURN. After announcing which computer it's running on, the Proofreader displays the message "Proofreader Active". Now you're ready to type in a BASIC program.

Every time you finish typing a line and press RETURN, the Proofreader displays a two-letter checksum in the upper-left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, it's almost certain the line was typed correctly. If the letters don't match, check for your mistake and correct the line.

The Proofreader ignores spaces not enclosed in quotes, so you can omit or add spaces between keywords and still see a matching checksum. However, since spaces inside quotes are almost always significant, the Proofreader pays attention to them. For example, **10 PRINT"THIS IS BASIC"** will generate a different checksum than **10 PRINT"THIS ISBA SIC"**.

A common typing error is transposition—typing two successive characters in the wrong order, like PIRNT instead of PRINT or 64378 instead of 64738. The Proofreader is sensitive to the *position* of each character within the line and thus catches transposition errors.

The Proofreader does *not* accept keyword abbreviations (for example, ? instead of PRINT). If you prefer to use abbreviations, you can still check the line by LISTing it after typing it in, moving the cursor back to the line, and pressing RETURN. LISTing the line substitutes the full keyword for the abbreviation and allows the Proofreader to work properly. The same technique works for rechecking programs you've already typed in.

If you're using the Proofreader on the Commodore 128, Plus/4, or 16, *do not perform any GRAPHIC commands while the Proofreader is active.* When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the Proofreader—to another memory area, causing the Proofreader to crash. The same thing happens if you *run* any program with a GRAPHIC command while the Proofreader is in memory.

Though the Proofreader doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. However, the Proofreader is purposely difficult to dislodge: It's not affected by tape or disk operations, or by pressing RUN/STOP– RESTORE. The simplest way to disable it is to turn the computer off then on. A gentler method is to SYS to the computer's built-in reset routine (SYS 65341 for the 128, 64738 for the 64, 65526 for the Plus/4 and 16, and 64802 for the VIC). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

If you own a Commodore 64, you may already have wondered whether the Proofreader works with other programming utilities like "MetaBASIC." The answer is generally yes, *if you're using a 64 and activate the Proofreader after installing the other utility.* For example, first load and activate MetaBASIC, then load and run the Proofreader.

When using the Proofreader with another utility, you should disable *both* programs before running a BASIC program. While the Proofreader seems unaffected by most utilities, there's no way to promise that it will work with any and every combination of utilities you might want to use. The more utilities activated, the more fragile the system becomes.

The New Automatic Proofreader

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
   ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
```

MLX Machine Language Editor For The Commodore 64

Ottis Cowper
Technical Editor

"MLX" is a labor-saving utility that will help you enter machine language program listings without error. MLX is required to enter all Commodore 64 machine language programs published in COMPUTE!'s GAZETTE. This version of MLX was first published in the January 1986 issue; it cannot be used to enter MLX programs published prior to that date, nor can earlier versions of MLX be used to enter the listings in this issue.

Type in and save a copy of MLX. You'll need it for all future machine language programs in COMPUTE!'s GAZETTE, as well as machine language (ML) programs in our companion magazine, COMPUTE!, and COMPUTE! books. When you're ready to enter an ML program, load and run MLX. It asks you for a starting and ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing. If you're unfamiliar with ML, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, MLX offers the option of clearing the workspace. The data you enter with MLX is kept in a special reserved area of memory; clearing this workspace area fills the reserved area with zeros, which will make it easier to find where you left off typing if you enter the listing in several sessions. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session there's no point in clearing the workspace, since the data you load in will fill the area with whatever values were in workspace memory at the time of the last Save.

At this point, MLX presents a menu of commands:

```
Enter data
Display data
Load data
Save file
Quit
```

Press the corresponding key to select a menu option. These commands are available only while the menu is displayed. You can get back to the menu from most options by pressing RETURN.

Entering A Listing

To begin entering data, press E. You'll be asked for the address at which you wish to begin. (If you pressed E by mistake, you can return to the command menu by pressing RETURN.) When you begin typing a listing, enter the starting address here. If you're typing in a long listing in several sessions, you should enter the address where you left off typing at the end of the previous session. In any case, make sure the address you enter corresponds to the address of a line in the MLX listing. Otherwise, you'll be unable to enter the data correctly.

After you enter the address, you'll see that address appear as a prompt with a nonblinking cursor. Now you're ready to enter data. To help prevent typing mistakes, only a few keys are active, so you may have to unlearn some habits. MLX listings consist of nine columns of two-digit numbers—eight bytes of data and a checksum. You *do not* type spaces between the columns; the new MLX automatically inserts these for you. Nor do you press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit. The only keys needed for data entry are 0–9 and A–F. Pressing most of the other keys produces a warning buzz.

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line badly, press CLR/HOME to start the line over. The RETURN key is also active, but only *before* any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line number prompt.

Beep Or Buzz?

After you type the last digit in a line, MLX calculates a checksum from the line number and the first eight columns of data, then compares it with the value in the ninth column. The formula (found in lines 370–390 of the MLX program) catches almost every conceivable typing error, including the transposition of numbers. If the values match, you'll hear a pleasant beep, the data is added to the workspace area, and the prompt for the next line of data appears (unless the line just entered was the last line of the listing—in which case you'll automatically advance to the Save option). But if MLX detects a typing error, you'll hear a low buzz and see an error message. Then MLX redisplays the line for editing.

To edit a line, move the cursor left and right using the cursor keys. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. To make corrections in a mistyped line, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Other MLX Functions

The Display data option lets you review your work. When you select D, you'll be asked for a starting address. (As with the other menu options, pressing RETURN at this point takes you back to the command menu.) Make sure the address corresponds to a line from the listing. You can pause the scrolling display by pressing the space bar. (MLX finishes printing the current line before halting.) To resume scrolling, press the space bar again. The display continues to scroll until the ending address is reached, then the menu reappears. To break out of the display and return to the menu before the ending address is reached, press RETURN. A quick way to check your typing is to compare the reverse video checksums on the screen with the data in the rightmost column of the printed listing. If the values match, you can be sure the line is entered correctly.

The Save and Load menu options are straightforward. First, MLX asks for a filename. (Again, pressing RETURN at this prompt without entering anything returns you to the command menu.) Next, MLX asks you to press either T or D for tape or disk. If you notice the disk drive starting and stopping several times during a load or save,

don't panic; this behavior is normal because MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands. For disk, the drive prefix 0: is automatically added to the filename (line 750), so this should *not* be included when entering the name. (This also precludes the use of @ for Save-with-Replace, so remember to give each version saved a different name.) MLX saves the entire workspace area from the starting to ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports any errors detected during the save or load. (Tape users should bear in mind that the Commodore 64 is never able to detect errors when saving to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you originally specified. If you get one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct ending address.

The Quit menu option has the obvious effect—it stops MLX and enters BASIC at a READY prompt. Since the RUN/STOP key is disabled, Q lets you exit the program without turning off the computer. (Of course, RUN/STOP-RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk or LOAD *"filename"* for tape, and then RUN. (Such programs usually have 0801 as their MLX starting address.) Others must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. (On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000.) In any case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

By the time you finish typing in the data for a long ML program, you'll have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type in MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. (Incidentally, MLX is included every month on the GAZETTE DISK.) Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape. Don't let a simple typing error in MLX cost you several nights of hard work.

MLX

For instructions on entering this listing, refer to "How To Type In COMPUTE!'s GAZETTE Programs" elsewhere in this issue.

```
EK 100 POKE 56,50:CLR:DIM IN$,
       I,J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z
       4=254:Z5=255:Z6=256:Z7=
       127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
       :BS=PEEK(55)+Z6*PEEK(56
       ):H$="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}"
       :S$=" ":D$=CHR$(20):Z$=
       CHR$(0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD
       +23:POKE I,0:NEXT:POKE
       {SPACE}SD+24,15:POKE 78
       8,52
FC 150 PRINT"{CLR}"CHR$(142)CH
       R$(8):POKE 53280,15:POK
       E 53281,15
EJ 160 PRINT T$" {RED}{RVS}
       {2 SPACES}{8 @}
       {2 SPACES}"SPC(28)"
       {2 SPACES}{OFF}{BLU} ML
       X II {RED}{RVS}
       {2 SPACES}"SPC(28)"
       {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}
       {3 SPACES}COMPUTE!'S MA
       CHINE LANGUAGE EDITOR
       {3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADD
       RESS{43}";:GOSUB300:SA=A
       D:GOSUB1040:IF F THEN18
       0
GF 190 PRINT"{BLK}{2 SPACES}EN
       DING ADDRESS{43}";:GOSUB
       300:EA=AD:GOSUB1030:IF
       {SPACE}F THEN190
KR 200 INPUT"{3 DOWN}{BLK}CLEA
       R WORKSPACE [Y/N]{43}";A
       $:IF LEFT$(A$,1)<>"Y"TH
       EN220
PG 210 PRINT"{2 DOWN}{BLU}WORK
       ING...";:FORI=BS TO BS+
       EA-SA+7:POKE I,0:NEXT:P
       RINT"DONE"
DR 220 PRINTTAB(10)"{2 DOWN}
       {BLK}{RVS} MLX COMMAND
       {SPACE}MENU {DOWN}{43}":
       PRINT T$"{RVS}E{OFF}NTE
       R DATA"
ED 230 PRINT T$"{RVS}D{OFF}ISP
       LAY DATA":PRINT T$"
       {RVS}L{OFF}OAD DATA"
JS 240 PRINT T$"{RVS}S{OFF}AVE
        FILE":PRINT T$"{RVS}Q
       {OFF}UIT{2 DOWN}{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HK 260 A=0:FOR I=1 TO 5:IF A$=
       MID$("EDLSQ",I,1)THEN A
       =I:I=5
FD 270 NEXT:ON A GOTO420,610,6
       90,700,280:GOSUB1060:GO
       TO250
EJ 280 PRINT"{RVS} QUIT ":INPU
       T"{DOWN}{43}ARE YOU SURE
        [Y/N]";A$:IF LEFT$(A$,
       1)<>"Y"THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IF
       LEN(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$
       =MID$(IN$,3):GOSUB320:A
       D=AD*256+A:RETURN
PP 320 A=0:FOR J=1 TO 2:A$=MID
       $(B$,J,1):B=ASC(A$)-C4+
       (A$>"@")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=
       0:A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(
       H$,B+1,1);:B=A-B*C6:PRI
       NT MID$(H$,B+1,1);:RETU
       RN
RR 360 A=INT(AD/Z6):GOSUB350:A
       =AD-A*Z6:GOSUB350:PRINT
       ":";
BE 370 CK=INT(AD/Z6):CK=AD-Z4*
       CK+Z5*(CK>Z7):GOTO390
PX 380 CK=CK*Z2+Z5*(CK>Z7)+A
JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"{DOWN}STARTING AT
       {43}";:GOSUB300:IF IN$<>
       N$ THEN GOSUB1030:IF F
       {SPACE}THEN400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA
       {SPACE}":GOSUB400:IF IN
       $=N$ THEN220
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F
        THEN PRINT IN$:PRINT"
       {UP}{5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$
       =S$:FOR J=1 TO 2:IF F T
       HEN B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<
       24THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A
       $>"@"ANDA$<"G")THEN540
MP 490 IF A$=R$ AND((I=0)AND(J
       =1)OR F)THEN PRINT B$;:
       J=2:NEXT:I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRI
       NT B$:J=2:NEXT:I=24:NEX
       T:F=0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF TH
       ENPRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR
       ((I=0)AND(J=1))THEN GOS
```

```
      UB1060:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;
      :J=2-J:IF J THEN PRINT
      {SPACE}L$;:I=I-3
QS 540 PRINT A$;:NEXT J:PRINT
      {SPACE}S$;
PM 550 NEXT I:PRINT:PRINT"{UP}
      {5 RIGHT}";:INPUT#3,IN$
      :IF IN$=N$ THEN CLOSE3:
      GOTO220
QC 560 FOR I=1 TO 25 STEP3:B$=
      MID$(IN$,I):GOSUB320:IF
       I<25 THEN GOSUB380:A(I
      /3)=A
PK 570 NEXT:IF A<>CK THEN GOSU
      B1060:PRINT"{BLK}{RVS}
      {SPACE}ERROR: REENTER L
      INE [4]":F=1:GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FO
      R I=0 TO 7:POKE B+I,A(I
      ):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN C
      LOSE3:PRINT"{DOWN}{BLU}
      ** END OF ENTRY **{BLK}
      {2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
QA 610 PRINT"{CLR}{DOWN}{RVS}
      {SPACE}DISPLAY DATA ":G
      OSUB400:IF IN$=N$ THEN2
      20
RJ 620 PRINT"{DOWN}{BLU}PRESS:
       {RVS}SPACE{OFF} TO PAU
      SE, {RVS}RETURN{OFF} TO
       BREAK[4]{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FOR
      I=BTO B+7:A=PEEK(I):GOS
      UB350:GOSUB380:PRINT S$
      ;
CC 640 NEXT:PRINT"{RVS}";:A=CK
      :GOSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA TH
      ENPRINT"{DOWN}{BLU}** E
      ND OF DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GO
      SUB1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOS
      UB1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD
      {SPACE}DATA ":OP=1:GOTO
      710
PC 700 PRINT"{DOWN}{RVS} SAVE
      {SPACE}FILE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILE
      NAME[4]";IN$:IF IN$=N$
      {SPACE}THEN220
PR 720 F=0:PRINT"{DOWN}{BLK}
      {RVS}T{OFF}APE OR {RVS}
      D{OFF}ISK: [4]";
FP 730 GET A$:IF A$="T"THEN PR
      INT"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8
      ,15,"I0:":B=EA-SA:IN$="
      0:"+IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":G
      OSUB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(A
      H*256):PRINT#1,CHR$(AL)
      ;CHR$(AH);
PE 780 FOR I=0 TO B:PRINT#1,CH
      R$(PEEK(BS+I));:IF ST T
      HEN800
FC 790 NEXT:CLOSE1:CLOSE15:GOT
      O940
GS 800 GOSUB1060:PRINT"{DOWN}
      {BLK}ERROR DURING SAVE:
      [4]":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":G
      OSUB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z
      $)+256*ASC(B$+Z$):IF AD
      <>SA THEN F=1:GOTO850
KH 830 FOR I=0 TO B:GET#1,A$:P
      OKE BS+I,ASC(A$+Z$):IF
      {SPACE}ST AND(I<>B)THEN
       F=2:AD=I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F
      >0)+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN
       CLOSE1:CLOSE15:GOSUB10
      60:PRINT"{RVS}ERROR: "A
      $
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE
      187,PEEK(FA+3):POKE188,
      PEEK(FA+4):IFOP=0THEN92
      0
HJ 890 SYS 63466:IF(PEEK(783)A
      ND1)THEN GOSUB1060:PRIN
      T"{DOWN}{RVS} FILE NOT
      {SPACE}FOUND ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(8
      30):IF AD<>SA THEN F=1:
      GOTO970
SC 910 A=PEEK(831)+256*PEEK(83
      2)-1:F=F-2*(A<EA)-3*(A>
      EA):AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:P
      OKE780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOS
      UB1010:ON OP GOTO950:SY
      S 63591
AE 940 GOSUB1080:PRINT"{BLU}**
       SAVE COMPLETED **":GOT
      O220
AX 950 POKE147,0:SYS 63562:IF
      {SPACE}ST<>64 THEN970
FR 960 GOSUB1080:PRINT"{BLU}**
       LOAD COMPLETED **":GOT
      O220
DP 970 GOSUB1060:PRINT"{BLK}
      {RVS}ERROR DURING LOAD:
      {DOWN}[4]":ON F GOSUB98
      0,990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTIN
      G ADDRESS (";:GOSUB360:
      PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:
      AD=SA+AD:GOSUB360:PRINT
       D$:RETURN
FD 1000 PRINT"TRUNCATED AT END
      ING ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH
      *256):POKE193,AL:POKE1
      94,AH
FF 1020 AH=INT(B/256):AL=B-(AH
      *256):POKE174,AL:POKE1
      75,AH:RETURN
FX 1030 IF AD<SA OR AD>EA THEN
      1050
HA 1040 IF(AD>511 AND AD<40960
      )OR(AD>49151 AND AD<53
      248)THEN GOSUB1080:F=0
      :RETURN
HC 1050 GOSUB1060:PRINT"{RVS}
      {SPACE}INVALID ADDRESS
       {DOWN}{BLK}":F=1:RETU
      RN
AR 1060 POKE SD+5,31:POKE SD+6
      ,208:POKE SD,240:POKE
      {SPACE}SD+1,4:POKE SD+
      4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
      TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
      240:POKE SD,0:POKE SD+
      1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
      KE SD+4,0:POKE SD,0:PO
      KE SD+1,0:RETURN
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Medium-Resolution Graphics For The 64

See instructions in article on page 88 before typing in.

Program 1: Medium Resolution 64

```
C738:20 FD AE 20 8A AD 20 AA 25
C740:B1 C9 00 D0 26 8C 3C 03 07
C748:20 FD AE 20 8A AD 20 AA 35
C750:B1 C9 00 D0 16 8C 3D 03 98
C758:20 FD AE 20 8A AD 20 AA 45
C760:B1 C9 00 D0 06 8C 40 03 2E
C768:4C 71 C7 A2 0E 20 37 A4 A1
C770:60 18 AD 3C 03 C9 50 B0 40
C778:0A AD 3D 03 C9 32 B0 03 CB
C780:4C 86 C7 4C 6B C7 AD 3C A7
C788:03 4A 8D 3E 03 AD 3D 03 0E
C790:4A 8D 3F 03 A9 00 85 FD 17
C798:85 FE AC 3E 03 AD 3F 03 74
C7A0:0A 26 FD 0A 26 FD 18 6D E5
C7A8:3F 03 85 FC A9 00 65 FD 2F
C7B0:85 FD 06 FC 26 FD 06 FC 45
C7B8:26 FD 06 FC 26 FD A9 04 EB
C7C0:65 FD 85 FD 84 02 B1 FC 9F
C7C8:8D 41 03 38 AD 3C 03 0E C5
C7D0:3E 03 ED 3E 03 AA E0 FF 66
C7D8:D0 05 A2 00 4C E1 C7 A2 82
C7E0:01 38 AD 3D 03 0E 3F 03 5A
C7E8:ED 3F 03 A8 C0 FF D0 05 D6
C7F0:A0 00 4C F7 C7 A0 01 A9 46
C7F8:7E E0 01 F0 0C C0 01 F0 85
C800:03 4C 14 C8 A9 7B 4C 14 1D
C808:C8 A9 7C C0 01 F0 03 4C 22
C810:14 C8 A9 6C A8 A2 00 AD 57
C818:41 03 DD 10 C9 F0 09 E8 D4
C820:E0 0F D0 F6 98 4C FF C8 2E
C828:C0 6C D0 31 A2 7F C9 7E 87
C830:F0 27 A2 E1 C9 7C F0 21 B9
C838:A2 62 C9 7B F0 1B A2 FE DC
C840:C9 FF F0 15 A2 FB C9 E2 A1
C848:F0 0F A2 FC C9 61 F0 09 F8
C850:A2 A0 C9 EC F0 03 4C FC 8C
C858:C8 8A 4C FF C8 C0 7B D0 8B
C860:31 A2 61 C9 7E F0 27 A2 A4
C868:FF C9 7C F0 21 A2 62 C9 2D
C870:6C F0 1B A2 FC C9 7F F0 01
C878:15 A2 EC C9 E2 F0 0F A2 13
C880:FE C9 E1 F0 09 A2 A0 C9 2D
C888:FB F0 03 4C FC C8 8A 4C E5
C890:FF C8 C0 7E D0 31 A2 61 46
C898:C9 7B F0 27 A2 E2 C9 7C 2F
C8A0:F0 21 A2 7F C9 6C F0 1B 3C
C8A8:A2 EC C9 FF F0 15 A2 FB 1D
C8B0:C9 E1 F0 0F A2 FC C9 62 AD
C8B8:F0 09 A2 A0 C9 FE F0 03 92
C8C0:4C FC C8 8A 4C FF C8 C0 2E
C8C8:7C D0 31 A2 FF C9 7B F0 2C
C8D0:27 A2 E2 C9 7E F0 21 A2 34
C8D8:E1 C9 6C F0 1B A2 FB C9 8F
C8E0:7F F0 15 A2 FE C9 62 F0 10
C8E8:0F A2 EC C9 61 F0 09 A2 68
C8F0:A0 C9 FC F0 03 4C FC C8 FF
C8F8:8A 4C FF C8 AD 41 03 A4 8C
C900:02 91 FC A5 FD 18 69 D4 EA
C908:85 FD AD 40 03 91 FC 60 50
C910:7B 7E 7C 6C 7F FF EC FB 29
```

```
C918:FC A0 FE E2 E1 62 61 0C C7
C920:0F 15 09 13 21 00 00 00 DB
```

Program 2: Medium Resolution Demo

```
RR 100 XF=28:YF=20:X0=39:Y0=25
       :SC=53281:BO=53280:F=80
       :G=50:CF=16:AD=51000
HQ 110 POKESC,0:POKEBO,0:GOSUB
       270:GOSUB300
RQ 120 FORX=0TO79:Y=.:SYS AD,X
       ,Y,6:Y=49:SYS AD,X,Y,6:
       NEXT
KS 130 FORY=0TO49:X=.:SYS AD,X
       ,Y,6:X=79:SYS AD,X,Y,6:
       NEXT
AQ 140 FORI=0TO15:SYS AD,I,I,6
       :SYS AD,(79-I),(49-I),6
       :SYS AD,I,(49-I),6
RK 150 SYS AD,(79-I),I,6:NEXT:
       FORX=16TO63:Y=15:SYS AD
       ,X,Y,7:Y=34:SYS AD,X,Y,
       7:NEXT
CD 160 FORY=16TO33:X=16:SYS AD
       ,X,Y,7:X=63:SYS AD,X,Y,
       7:NEXT
MM 170 PRINT"{HOME}{12 DOWN}"T
       AB(10)"{GRN}80 BY 50 ME
       DIUM-RES"
MX 180 GOSUB300:K=0:C=1:FORZ=1
       TO7:C=C+1
BG 190 FORY=0TO49STEP5:FORX=KT
       OK+5:SYS AD,X,Y,C:Y=Y+1
       :NEXTX,Y:K=K+12:NEXTZ:K
       =6
HH 200 FORZ=1TO6:C=C+1:FORY=49
       TO0STEP-5:FORX=KTOK+5:S
       YS AD,X,Y,C:Y=Y-1:NEXTX
       ,Y
FE 210 K=K+12:NEXTZ:GOSUB300
HQ 220 FORI=0TO2*↑STEP↑/85:X=X
       0+COS(I)*XF:Y=Y0+SIN(I)
       *YF:SYS AD,X,Y,6:NEXT
PJ 230 FORI=0TO2*↑STEP↑/40:X=3
       9.5+COS(I)*10:Y=24.5+SI
       N(I)*8:SYS AD,X,Y,5:NEX
       T
BQ 240 GOSUB300
PQ 250 FORI=1TO200:X=RND(1)*F:
       Y=RND(1)*G:C=RND(1)*CF:
       SYS AD,X,Y,C:NEXT
RH 260 GOSUB300:END
BG 270 PRINT"{CLR}{BLU}
       {3 DOWN}{4 SPACES}AFTER
        EACH IMAGE IS DRAWN, P
       RESS"
SC 280 PRINTTAB(10)"{DOWN}ANY
       {SPACE}KEY TO CONTINUE.
       "
JG 290 PRINTTAB(12)"{4 DOWN}(P
       RESS ANY KEY)":RETURN
RQ 300 POKE198,0:WAIT198,1:POK
       E198,0:PRINT"{CLR}":RET
       URN
```

Video Setup 128

Article on page 78.

```
DB 10 PRINT "128 SCREEN SETUP"
BB 20 PRINT "SETS UP THE 40-CO
      L SCREEN AREA ONLY"
AG 30 DIM S(255)
PA 40 INPUT "DO YOU WANT A SPL
      IT SCREEN";Y$
EE 50 Y$=LEFT$(Y$,1)
RQ 60 J9=1:IF Y$="N" GOTO 90
DD 70 J8=1:J9=2:IF Y$="Y" THEN
       B5=64:GOTO 90
MG 80 GOTO 40
BQ 90 S0=16384:IF J9=2 GOTO 16
      0
GF 100 PRINT "WANT TO USE:"
GA 110 PRINT "1. CHARACTERS
JG 120 PRINT "2. HIGH RES
SP 130 INPUT "1 OR 2";J8
FK 140 IF J8<1 OR J8>2 GOTO 10
      0
DD 150 J9=J8
EB 160 PRINT
RX 170 PRINT "PICK A MEMORY BA
       NK FOR VIDEO:"
EA 180 PRINT "BANK 0 (PROGRAM
       {SPACE}AREA)"
SJ 190 PRINT "BANK 1 (VARIABLE
        AREA)"
PD 200 PRINT "YOUR CHOICE (0 O
       R 1)";
XD 210 INPUT B%:IF B%<0 OR B%>
       1 GOTO 160
XF 220 PRINT
EX 230 PRINT "PICK A MEMORY AR
       EA:"
RE 240 FOR J=0 TO 3
BP 250 PRINT J;": ";J*S0;"TO";
       (J+1)*S0-1
EG 260 NEXT J
HH 270 PRINT "YOUR CHOICE (0 T
       O 3)";
XA 280 INPUT B:IF B<0 OR B>3 G
       OTO 220
HS 290 IF B=0 THEN FOR J=0 TO
       {SPACE}3:S(J)=2:NEXT J
JB 300 IF B=3 THEN FOR J=252 T
       O 255:S(J)=2:NEXT J
QQ 310 REM
CG 320 FOR J0=J8 TO J9
KB 330 IF J0=1 THEN PRINT "--C
       HARACTER SCREEN--":S=32
JG 340 IF J0=2 THEN PRINT "--H
       I RES SCREEN--":S=128
XP 350 ON J0 GOSUB 910,1020
MS 360 INPUT "ARE YOU READY FO
       R DATA";Y$
BB 370 IF LEFT$(Y$,1)<>"Y" GOT
       O 360
EC 380 PRINT "{CLR}{2 DOWN}"
AE 390 PRINT "{5 SPACES}VIDEO
       {SPACE}LOCATIONS ";:IF
       {SPACE}J0<>J8 THEN PRIN
       T "CONTINUED";
HE 400 PRINT ":":PRINT "ALL IN
        BANK";B%
SB 410 PRINT
MQ 420 IF B5=32 THEN PRINT "HI
       GH RESOLUTION."
AF 430 IF B5=160 THEN PRINT "H
       IGH RES MULTICOLOR."
FA 440 IF J0=1 THEN PRINT "TEX
       T SCREEN"
RR 450 PRINT "VIDEO MATRIX:";B
       *S0+V*64;"TO";B*S0+(V+1
       6)*64-1
RE 460 PRINT "(SPRITE POINTERS
        AT";B*S0+V*64+1016;"TO
       ";B*S0+V*64+1023;")"
EC 470 IF J0=1 AND B3=0 THEN P
       RINT "STANDARD CHARACTE
       R SET.":C=64:GOTO 490
HM 480 PRINT "CHARACTER BASE:"
       ;B*S0+C*64;"TO";B*S0+(C
       +S)*64-1
SH 490 PRINT
QK 500 PRINT "** SET 'BANK 15'
        FOR FOLLOWING POKES **
       ":IF J0<>J8 GOTO 550
BF 510 PRINT "POKE 54534,";MID
       $(STR$(4+B%*64),2)
GS 520 PRINT "{4 SPACES}(TO SE
       T MEMORY BANK)"
PF 530 PRINT "POKE 56576,";MID
       $(STR$(7-B),2)
HH 540 PRINT "{4 SPACES}(TO SE
       T MEMORY BLOCK)"
DQ 550 REM
CF 560 PRINT "POKE";STR$(2603+
       J0);",";MID$(STR$(V+C/1
       6),2)
EP 570 PRINT "{4 SPACES}(TO SE
       T VM AND CB)"
BC 580 IF J0=1 THEN GOSUB 1360
DH 590 IF J0<>J9 GOTO 660
AS 600 PRINT "POKE 216,";MID$(
       STR$(B5),2)
BQ 610 IF B5<>0 THEN PRINT "
       {4 SPACES}(TO ENABLE HI
        RES)"
FQ 620 IF B5=0 THEN PRINT "
       {4 SPACES}(TO KILL HI R
       ES)"
RX 630 PRINT "POKE 217,";MID$(
       STR$(B3),2)
MK 640 IF B3>0 THEN PRINT "
       {4 SPACES}(TO KILL ROM
       {SPACE}CHARACTER GENERA
       TOR)"
FX 650 IF B3=0 THEN PRINT "
       {4 SPACES}(TO RESTORE R
       OM CHARGEN, IF NEEDED)"
GS 660 PRINT "*** PRESS ANY KE
       Y TO CONTINUE ***"
AF 670 GET Y$,Y$,Y$,Y$
MC 680 GET Y$:IF Y$="" GOTO 68
       0
KR 690 NEXT J0
BR 700 INPUT "WILL YOU WANT SP
       RITES";Y$
EK 710 IF Y$="N" GOTO 800
QJ 720 IF Y$<>"Y" GOTO 700
HP 730 PRINT "SPRITES MAY BE P
       LACED AT:"
KQ 740 F=-1
EX 750 FOR J=0 TO 255
KA 760 IF S(J)=0 AND F=-1 THEN
        GOSUB 850
PC 770 IF S(J)<>0 AND F<>-1 TH
       EN GOSUB 880
RJ 780 NEXT J
KK 790 IF F<>-1 THEN GOSUB 880
HK 800 PRINT
JE 810 PRINT "CAREFUL:"
KA 820 IF B%=0 THEN PRINT "BAS
       IC IS USUALLY IN 7169 T
       O 65279"
EE 830 IF B%=1 THEN PRINT "VAR
       IABLES ARE USUALLY AT 1
       024 TO 65279"
CM 840 END
KP 850 P=J
SX 860 F=0
GQ 870 RETURN
DJ 880 PRINT S0*B+P*64;"TO";S0
       *B+J*64-1;"(SPRITES";P;
       "TO";J-1;")"
PG 890 F=-1
HX 900 RETURN
DK 910 B3=4
XG 920 PRINT "DO YOU WANT TO B
       UILD
RJ 930 PRINT "{3 SPACES}YOUR O
       WN CHARACTER SET (Y/N)"
       ;
KJ 940 INPUT Y$:Y$=LEFT$(Y$,1)
RX 950 IF Y$="Y" GOTO 990
AE 960 IF Y$<>"N" GOTO 910
AA 970 B3=0:C=64
BF 980 FOR J=64 TO 127:S(J)=1:
       NEXT J
BG 990 IF B3>0 THEN PRINT "THE
        CHARACTER SET MAY BE A
       T:":GOSUB 1100
CS 1000 PRINT "VIDEO MATRIX (S
        CREEN MEMORY)...":GOSU
        B 1250
```

```
DS 1010 RETURN
FE 1020 B5=B5+32:T=1
RK 1030 INPUT "DO YOU WANT MUL
        TICOLOR";Y$
XR 1040 Y$=LEFT$(Y$,1)
CR 1050 IF Y$="Y" THEN B5=B5+1
        28:GOTO 1070
MQ 1060 IF Y$<>"N" GOTO 1020
XF 1070 PRINT "THE HI-RES SCRE
        EN MAY BE AT:":GOSUB 1
        100
KB 1080 PRINT "VIDEO MATRIX (C
        OLOR MEMORY)...":GOSUB
         1250
QE 1090 RETURN
GX 1100 N=0:FOR J=0 TO 255 STE
        P S
XQ 1110 FOR K=J TO J+S-1 STEP
        {SPACE}16
XP 1120 IF S(K)>T OR S(K+15)>T
         GOTO 1150
ED 1130 NEXT K
QD 1140 PRINT "(";J/S;")";B*S0
        +J*64;"TO";B*S0+(J+S)*
        64-1:N=N+1:C=J/S
HC 1150 NEXT J
PS 1160 IF N<1 GOTO 1380
AH 1170 IF N<2 GOTO 1210
QS 1180 PRINT "YOUR CHOICE (0
        {SPACE}TO";(J-S)/S;")"
        ;
XP 1190 INPUT C0:IF C0<0 OR C0
        >C GOTO 1100
PM 1200 C=C0
AG 1210 C=C*S
BG 1220 FOR J=C TO C+S-1:S(J)=
        3:NEXT J
MJ 1230 PRINT
HX 1240 RETURN
QA 1250 FOR J=0 TO 255 STEP 16
HQ 1260 IF S(J)>T OR S(J+15)>T
         GOTO 1280
DM 1270 PRINT "(";J/16;")";B*S
        0+J*64;"TO";B*S0+(J+16
        )*64-1:V=J/16
CR 1280 NEXT J
SE 1290 PRINT "YOUR CHOICE (0
        {SPACE}TO";V;")";
AA 1300 INPUT C0:IF C0<0 OR C0
        >V GOTO 1290
EH 1310 V=C0
BM 1320 V=V*16
RF 1330 FOR J=V TO V+15:S(J)=3
        :NEXT J
QB 1340 PRINT
DE 1350 RETURN
JA 1360 IF B%<>0 OR B<>0 OR V<
        >16 THEN PRINT "YOU CA
        N'T USE 'PRINT' TO THI
        S SCREEN"
FG 1370 RETURN
GP 1380 PRINT "AAARRRRRGH!
        {2 SPACES}IT WON'T FIT
        !"
JK 1390 PRINT "I GIVE UP."
```

One-Touch Function Keys

See instructions in article on page 82 before typing in.

```
C000:78 A9 0D 8D 14 03 A9 C0 63
C008:8D 15 03 58 60 A2 00 BD C6
C010:E9 C0 9D 00 04 E8 E0 28 18
C018:D0 F5 A5 C5 C9 40 D0 06 87
C020:8D 11 C1 4C 31 EA CD 11 8B
C028:C1 F0 F8 8D 11 C1 C9 04 E5
C030:F0 42 C9 05 F0 2C C9 06 16
C038:F0 16 C9 03 D0 E5 A2 00 84
C040:BD 12 C1 9D 77 02 E8 E0 AD
C048:04 D0 F5 86 C6 4C 31 EA DB
C050:A2 00 BD 16 C1 9D 77 02 B1
C058:E8 E0 04 D0 F5 86 C6 4C B7
C060:31 EA A2 00 BD 1A C1 9D 01
C068:77 02 E8 E0 05 D0 F5 86 2F
C070:C6 4C 31 EA 78 A9 31 8D 97
C078:14 03 A9 EA 8D 15 03 58 C7
C080:A9 93 20 D2 FF A9 08 AA 4E
C088:A0 00 20 BA FF A9 01 A2 55
C090:E8 A0 C0 20 BD FF 20 C0 B7
C098:FF A2 08 20 C6 FF 20 E4 21
C0A0:FF 20 E4 FF 20 E1 FF F0 40
C0A8:31 20 E4 FF 20 E4 FF A5 A1
C0B0:90 D0 27 20 E4 FF 8D 11 E8
C0B8:C1 20 E4 FF AE 11 C1 20 1D
C0C0:CD BD A9 20 20 D2 FF 20 3C
C0C8:E4 FF F0 06 20 D2 FF 4C D3
C0D0:C7 C0 A9 0D 20 D2 FF 4C 05
C0D8:A4 C0 20 CC FF A9 08 20 84
C0E0:C3 FF 20 00 C0 4C 31 EA CC
C0E8:24 20 86 B1 2D 2D 04 09 9F
C0F0:12 20 20 86 B3 2D 2D 0C A8
C0F8:09 13 14 20 20 86 B5 2D FB
C100:2D 13 01 16 05 20 20 86 CF
C108:B7 2D 2D 0C 0F 01 04 20 BD
C110:20 3F 4C 4F 41 44 53 41 F4
C118:56 45 4C 49 53 54 0D 00 3C
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Connect 'Em

Article on page 52.

Program 1: Connect 'Em—64 Version

```
GB 10 DIM BX(8,13),ZO(84),ZX(4
      ,4)
CB 20 FORA=679TO743:READB:CH=C
      H+B:POKEA,B:NEXT
CJ 30 FORX=0TO4:FORY=1TO4:READ
      ZX(X,Y):CH=CH+ZX(X,Y):NE
      XT:NEXT
PR 40 IFCH<>6391THENPRINT"DATA
       ERROR":END
GF 50 POKE785,167:POKE786,2
HP 60 DATA 32,247,183,165,20,2
      01,3,176,26,73,3,170,189
      ,255,219,41,15,133,2,169
GF 70 DATA 15,56,229,2,170,189
      ,221,2,168,169,0,32,145,
      179,96,160,0,41,1,170,18
      9
KX 80 DATA 0,220,41,16,208,1,2
      00,169,0,32,145,179,96,0
      ,1,3,0,4,8,7,0,2,5,6
JD 90 DATA 1,40,42,81,-1,0,0,2
      ,0,-1,0,80,0,1,2,82,1,0,
      80,82
AH 100 PRINT"{CLR}":S=1024:C=5
       4272:CH=81:CL=2:OX=46:P
       1=0:P2=0:IN$="":LX=28:U
       X=12
GE 110 POKE53280,15:POKE53281,
       1:FORT=0TO3:PC$(T)="":B
       Z$(T)="":NEXT
JQ 120 X=7:Y=6:V=S+40*X+Y:OV=V
       :PL=1:OL=46:DT$=""
ME 130 GOSUB710:IFPC$(1)<>"X"T
       HENPOKEV,CH:POKEV+C,14:
       X=7:Y=6:GOTO150
SQ 140 GOTO1210
QP 150 A=USR(PL):IFA=0GOTO210
MF 160 IFA=1THENX=X-1
MM 170 IFA=2THENY=Y+1
CF 180 IFA=3THENX=X+1
CS 190 IFA=4THENY=Y-1
GA 200 GOTO260
AP 210 B=USR(PL+2):IFB=0GOTO15
       0
MP 220 IFOL=66GOTO690
MH 230 IFOL<>46THENGOSUB1440:G
       OTO150
SK 240 GOSUB1460:IFD1=0THEND1=
       V:GOTO150
HB 250 D2=V:GOTO360
PM 260 IFX<7THENX=7
KA 270 IFX>21THENX=21
XP 280 IFY<6THENY=6
RK 290 IFY>LXTHENY=LX
PC 300 V=S+40*X+Y
HX 310 IFPC$(PL)="X"THENOL=OX:
       OC=OY
QH 320 POKEOV,OL:POKEOV+C,OC
XA 330 OL=PEEK(V):OC=PEEK(V+C)
       :POKEV,CH:POKEV+C,14:OV
       =V:OX=OL
XH 340 IFPC$(PL)<"X"THENOY=OC
GK 350 GOTO150
JF 360 AA=D1:BB=D2:BX$="":IFD1
       <D2GOTO380
JJ 370 A=D1:D1=D2:AA=D2:D2=A
MM 380 E=D2-D1:IFE=2THENDI$="A
       ":GOTO410
SM 390 IFE=80THENDI$="D":GOTO4
       70
KH 400 GOSUB1440:D2=0:D1=0:GOT
       O150
EF 410 E=PEEK(AA+1):IFE=111GOT
       O400
CS 420 POKED1+1,111
RD 430 IFPC$(PL)=""GOTO560
DD 440 GOSUB1540
JS 450 FORE=1TO8:POKED1+1,32:F
       ORK=1TO50:NEXT:POKED1+1
       ,111:FORK=1TO75:NEXT
CD 460 NEXT:GOTO560
HQ 470 E=PEEK(AA+40):IFE=66GOT
       O400
KQ 480 POKED1+40,66:POKED1+40+
       C,2:POKED2,66:POKED2+C,
       2:IFPC$(PC)="X"GOTO540
DC 490 IFPC$(PL)=""GOTO540
HM 500 GOSUB1540:IFV=D2THENOX=
       66:OY=2
EB 510 FORE=1TO8:POKED1+40,32:
       POKED2,32:FORK=1TO50:NE
       XT:POKED1+40,66:POKED2,
       66
QS 520 POKED1+40+C,2:POKED2+C,
       2
FD 530 FORK=1TO75:NEXT:NEXT
MQ 540 IFOV=D2ANDPL=1THENOX=66
       :OY=2
HH 550 IFOV=D2THENOL=66:OC=2
JC 560 XX=AA-S:FORK=1TO21:XX=X
       X-40:YY=XX:IFYY<40THENX
       X=K:K=21
AF 570 NEXT
CB 580 ROW=(XX-7)/2+1:COL=(YY-
       6)/2+1
JM 590 BX(RO,CO)=BX(RO,CO)+1:T
       Y$="N"
BQ 600 IFBX(RO,CO)=4THENBX$="X
       ":GOSUB1480:GOSUB880:GO
       SUB950
CP 610 IFDI$="A"THENBX(ROW-1,C
       OL)=BX(ROW-1,COL)+1:TY$
       ="A":IFBX(RO-1,CO)=4GOT
       O650
KE 620 IFDI$="A"GOTO660
```

```
PE 630 BX(ROW,COL-1)=BX(ROW,CO
       L-1)+1:TY$="D"
GH 640 IFBX(ROW,COL-1)<>4GOTO6
       60
BP 650 BX$="X":GOSUB1480:GOSUB
       880:GOSUB950
JQ 660 D1=0:D2=0:IFBX$=""THENP
       L=PL+1:GOSUB950
ME 670 IFPC$(PL)="X"GOTO1210
AD 680 POKEV,CH:POKEV+C,14:OV=
       V:GOTO150
JA 690 E=X:FORK=1TO9:E=E-2:IFE
       =0THENGOSUB1440:GOTO150
GK 700 NEXT:GOTO240
JK 710 PRINT"{CLR}":PRINTTAB(8
       )"{RVS}{3} WELCOME TO C
       ONNECT'EM ":PRINT:PRINT
       :GOSUB1480
HP 720 TS=84:GOSUB1460
PX 730 PRINT"{BLU}TO PLAY THE
       {SPACE}COMPUTER, ENTER
       {SPACE}{3}C-64"
ER 740 PRINT"{BLU}FOR EITHER O
       R BOTH PLAYER'S NAMES..
       ":PRINT:PRINT:FORT=1TO2
       500:NEXT
EH 750 FORI=1TO2:GOSUB1460:PRI
       NT"{BLU}WHAT IS PLAYER
       {SPACE}#"I"{LEFT}'S NAM
       E{3}";:INPUTPL$(I)
JM 760 PL$(I)=LEFT$(PL$(I),8):
       NEXT
ES 770 PRINT:GOSUB1460:F1=-1:F
       2=0:PRINT:FORT=1TO2:Z$=
       LEFT$(PL$(T),1):A=ASC(Z
       $)
RJ 780 FL(T)=A-64:F1=F1+4:NC(T
       )=F1:IFPL$(T)="C-64"THE
       NF2=F2+1:PC$(T)="X"
FQ 790 IFT=2ANDF2=2THENPL$(T)=
       "COMMODORE"
BB 800 PRINT"{3}{2 SPACES}";PL
       $(T);"{BLU} WILL USE JO
       YSTICK";T:NEXT
CX 810 L%=LEN(PL$(1)):M%=LEN(P
       L$(2)):L%=(L%/2)+7:M%=(
       M%/2)+23
RF 820 PRINT:PRINT:PRINT"{BLU}
       REGULAR OR MINI GAME (R
       /M)?"
MG 830 GETZ$:IFZ$="R"GOTO860
DD 840 IFZ$<>"M"GOTO830
QF 850 LX=18:UX=7:TS=42
MX 860 FORX=1TOUX:DT$=DT$+". "
       :NEXT
GG 870 GOSUB1480:GOSUB950:RETU
       RN
QR 880 IFTY$="N"THENAA=RO:BB=C
       O
HS 890 IFTY$="A"THENAA=RO-1:BB
       =CO
MP 900 IFTY$="D"THENAA=RO:BB=C
       O-1
FE 910 A=(AA*2+7)-2:B=BB*2+4:E
       =S+A*40+B+41
SH 920 AA=FL(PL):CL=NC(PL)
GS 930 POKEE,AA+128:POKEE+C,CL
       :CL=2:RETURN
QM 940 PRINT"{HOME}":FORJ=1TOC
       C:PRINT:NEXT:RETURN
AM 950 IFIN$=""THENBX$="":PRIN
       T"{CLR}"
MC 960 PRINT"{HOME}":PRINTTAB(
       9)"{RVS}{BLU} CONNECT'E
       M SCOREBOARD ":PRINT
KB 970 IFBX$<>"X"GOTO1000
XP 980 IFPL=1THENP1=P1+1:GOTO1
       000
QG 990 P2=P2+1:PL=2
FG 1000 PRINTTAB(8)"{RVS}{CYN}
       "+PL$(1);TAB(24)"{RVS}
       {YEL}"+PL$(2):IFPL>2TH
       ENPL=1
RQ 1010 PRINTTAB(L%)"{3}";P1;T
       AB(M%)P2
AE 1020 POKE781,6:SYS59903:NA$
       =PL$(PL):POKE646,NC(PL
       )
MR 1030 PRINT:PRINTTAB(4)NA$;"
       'S TURN":IFPC$(PL)=""T
       HENGOSUB1460
QG 1040 IFIN$<>""GOTO1070
PR 1050 IN$="X":CC=6:GOSUB940
PS 1060 FORX=1TO8:PRINTTAB(6)"
       {RED}";DT$:PRINT:NEXT:
       TI$="000000"
KH 1070 GOSUB1200
BA 1080 A=P1+P2:IFA=TSGOTO1100
QE 1090 RETURN
RD 1100 WN$=" WINS!!":NA$=PL$(
       1)+WN$:IFP2=P1THENNA$=
       "IT'S A TIE!!":GOTO112
       0
MB 1110 POKE646,NC(1):IFP2>P1T
       HENNA$=PL$(2)+WN$:POKE
       646,NC(2)
FG 1120 CC=22:GOSUB940
QR 1130 FORX=1TO7:POKE781,22:S
       YS59903:GOSUB1480:PRIN
       TTAB(12)"{UP}";NA$
MP 1140 FORY=1TO300:NEXT:NEXT
JK 1150 PRINTTAB(7)"{3}CARE TO
        PLAY AGAIN (Y/N)?"
SB 1160 GETZ$:IFZ$=""GOTO1160
RS 1170 IFZ$="N"THENEND
GS 1180 IFZ$<>"Y"THENGOTO1160
ME 1190 FORA=1TO7:FORB=1TO12:B
       X(A,B)=0:NEXT:NEXT:D1=
       0:D2=0:GOTO100
DX 1200 PRINT"{HOME}":PRINT"
       {PUR}";LEFT$(TI$,2);":
       ";MID$(TI$,3,2);":";RI
       GHT$(TI$,2):RETURN
DM 1210 NZ=0:VA=-1:NX=0:GOSUB1
       510
AC 1220 VA=VA+1:NL=VA+1
DH 1230 IFBZ$(VA)="X"GOTO1220
MG 1240 FORA=1TO7:FORB=1TOUX-1
KH 1250 IFBX(A,B)=3THENNZ=0:NL
       =4:NX=0:GOSUB1380:A=7:
       B=UX-1:GOTO1270
DE 1260 IFBX(A,B)=VATHENGOSUB1
       380
EK 1270 NEXT:NEXT:NX=0:IFNZ>0G
       OTO1290
JP 1280 BZ$(VA)="X":GOTO1220
QJ 1290 R=INT(RND(1)*NZ)+1:IFN
       X=NZTHENNZ=0:GOTO1220
KJ 1300 IFZO(R)=99GOTO1290
CQ 1310 NX=NX+1:LOC=ZO(R)
DJ 1320 FORZ=1TO4:RX$(Z)="":NE
       XT:RX=0
PK 1330 IFRX=4THENZO(R)=99:GOT
       O1290
DM 1340 Z=INT(RND(1)*4)+1:IFRX
       $(Z)="X"GOTO1340
XD 1350 RX=RX+1:RX$(Z)="X"
JX 1360 E=PEEK(LOC+ZX(0,Z)):IF
       E=32THENGOSUB1390:GOTO
       1420
JG 1370 GOTO1330
FX 1380 E=(A*2+7)-2:K=B*2+4:LO
       C=S+E*40+K:NZ=NZ+1:ZO(
       NZ)=LOC:RETURN
SJ 1390 XX=LOC-S:FORK=1TO21:XX
       =XX-40:YY=XX:IFYY<40TH
       ENXX=K:K=21
CJ 1400 NEXT
RS 1410 ROW=(XX-7)/2+1:COL=(YY
       -6)/2+1:RETURN
GM 1420 IFBX(ROW+ZX(Z,1),COL+Z
       X(Z,2))<NLTHEND1=LOC+Z
       X(Z,3):D2=LOC+ZX(Z,4):
       GOTO360
GM 1430 GOTO1330
MQ 1440 GOSUB1570:POKEC+5,45:P
       OKEC+6,165:POKEC+4,33:
       POKEC+1,6:POKEC,5
SF 1450 FORT=1TO200:NEXT:POKEC
       +4,32:POKEC+1,0:POKEC,
       0:RETURN
EE 1460 GOSUB1570:POKEC+5,0:PO
       KEC+6,247:POKEC+4,17
KG 1470 POKEC+1,40:POKEC,0:FOR
       T=1TO100:NEXT:POKEC+4,
       16:RETURN
EF 1480 GOSUB1570:POKEC+5,0:PO
       KEC+6,255:POKEC+4,21
FF 1490 POKEC+15,40:FORA=1TO4:
       F1=20:FORB=1TO2:F2=100
       :POKEC+1,F1:FORK=1TO2
SJ 1500 POKEC+15,F2:F1=F1*1.05
       :F2=F2*.9:NEXTK:NEXTB:
       NEXTA:POKEC+6,15:RETUR
       N
CR 1510 GOSUB1570:POKEC+5,6:FO
       RZ=1TO15
PE 1520 A=INT(10*RND(1))+1:Q=I
       NT(25*RND(1))+1:POKEC+
       1,40:F2=INT(15*RND(1))
       +1
JJ 1530 POKEC+15,F2:POKEC+4,23
       :FORT=1TOQ:NEXT:POKEC+
       4,128:NEXTZ:RETURN
XK 1540 GOSUB1570:POKEC+5,8:PO
       KEC+6,255:POKEC+4,23
KD 1550 POKEC+15,40:FORZ=1TO4:
       FORF1=255TO0STEP-6:POK
       EC+1,F1:NEXTF1
XK 1560 FORF1=0TO255STEP10:POK
       EC+1,F1:NEXTF1:POKEC+6
       ,10:RETURN
JS 1570 FORL=CTOC+23:POKEL,0:N
       EXT:POKEC+24,15:RETURN
```

Program 2: Connect 'Em—128 Version

(Refer to the article for modifications needed to use this version with the Plus/4 and 16.)

```
GB 10 DIM BX(8,13),ZO(84),ZX(4
      ,4)
FX 20 FOR X=0 TO 4:FOR Y=1 TO
      {SPACE}4:READ ZX(X,Y):CH
      =CH+ZX(X,Y):NEXT:NEXT
DM 30 IF CH<>492 THEN PRINT"DA
      TA ERROR":END
SS 40 DATA 1,40,42,81,-1,0,0,2
      ,0,-1,0,80,0,1,2,82,1,0,
      80,82
JX 50 BANK15:PRINT"{CLR}":S=10
      24:C=54272:RR=235:CC=241
      :CH=81:CL=2:OX=46:P1=0:P
      2=0:IN$="":LX=28:UX=12
KQ 60 COLOR 4,2,5:COLOR 0,2:FO
      R T=0 TO 3:PC$(T)="":BZ$
      (T)="":NEXT
DR 70 X=7:Y=6:V=S+40*X+Y:OV=V:
      PL=1:OL=46:DT$=""
KX 80 GOSUB 660:IF PC$(1)<>"X"
       THEN POKE V,CH:POKE V+C
      ,14:X=7:Y=6:GOTO 100
RD 90 GOTO 1170
GC 100 A=JOY(PL):IF A=0 THEN 1
       00
XR 110 IF A>127 THEN 170
MG 120 IF A=1 THEN X=X-1
CH 130 IF A=3 THEN Y=Y+1
CH 140 IF A=5 THEN X=X+1
MK 150 IF A=7 THEN Y=Y-1
DP 160 GOTO 210
JM 170 IF OL=66 THEN 640
KF 180 IF OL<>46 THEN GOSUB 14
       00:GOTO 100
```

```
FK 190 GOSUB 1410:IF D1=0 THEN
       D1=V:GOTO 100
JK 200 D2=V:GOTO 310
XG 210 IF X<7 THEN X=7
CQ 220 IFX>21 THEN X=21
DE 230 IF Y<6 THEN Y=6
KF 240 IF Y>LX THEN Y=LX
EA 250 V=S+40*X+Y
SR 260 IF PC$(PL)="X" THEN OL=
       OX:OC=OY
HF 270 POKE OV,OL:POKE OV+C,OC
GD 280 OL=PEEK(V):OC=PEEK(V+C)
       :POKE V,CH:POKE V+C,14:
       OV=V:OX=OL
KM 290 IF PC$(PL)<"X" THEN OY=
       OC
BC 300 GOTO 100
HC 310 AA=D1:BB=D2:BX$="":IF D
       1<D2 THEN 330
ER 320 A=D1:D1=D2:AA=D2:D2=A
KB 330 E=D2-D1:IF E=2 THEN DI$
       ="A":GOTO 360
KG 340 IF E=80 THEN DI$="D":GO
       TO 420
QE 350 GOSUB 1400:D2=0:D1=0:GO
       TO 100
HD 360 E=PEEK(AA+1):IF E=111 T
       HEN 350
FR 370 POKE D1+1,111
RK 380 IF PC$(PL)="" THEN 510
BA 390 GOSUB 1470
EC 400 FOR E=1 TO 8:POKE D1+1,
       32:FOR K=1 TO 50:NEXT:P
       OKE D1+1,111:FOR K=1 TO
        75:NEXT
BP 410 NEXT:GOTO 510
HM 420 E=PEEK(AA+40):IF E=66 T
       HEN 350
QJ 430 POKE D1+40,66:POKE D1+4
       0+C,2:POKE D2,66:POKE D
       2+C,2:IF PC$(PC)="X" TH
       EN 490
DF 440 IF PC$(PL)="" THEN 490
FP 450 GOSUB 1470:IF V=D2 THEN
        OX=66:OY=2
DC 460 FOR E=1 TO 8:POKE D1+40
       ,32:POKE D2,32:FOR K=1
       {SPACE}TO 50:NEXT:POKE
       {SPACE}D1+40,66:POKE D2
       ,66
DR 470 POKE D1+40+C,2:POKE D2+
       C,2
QG 480 FOR K=1 TO 75:NEXT:NEXT
FM 490 IF OV=D2 AND PL=1 THEN
       {SPACE}OX=66:OY=2
CP 500 IF OV=D2 THEN OL=66:OC=
       2
QG 510 XX=AA-S:FOR K=1 TO 21:X
       X=XX-40:YY=XX:IF YY<40
       {SPACE}THEN XX=K:K=21
EB 520 NEXT

GF 530 ROW=(XX-7)/2+1:COL=(YY-
       6)/2+1
MP 540 BX(ROW,COL)=BX(ROW,COL)
       +1:TY$="N"
EG 550 IF BX(ROW,COL)=4 THEN B
       X$="X":GOSUB 1420:GOSUB
        840:GOSUB 910
HS 560 IF DI$="A" THEN BX(ROW-
       1,COL)=BX(ROW-1,COL)+1:
       TY$="A":IF BX(ROW-1,COL
       )=4 THEN 600
HB 570 IF DI$="A" THEN 610
AM 580 BX(ROW,COL-1)=BX(ROW,CO
       L-1)+1:TY$="D"
JD 590 IF BX(ROW,COL-1)<>4 THE
       N 610
BS 600 BX$="X":GOSUB 1420:GOSU
       B 840:GOSUB 910
RS 610 D1=0:D2=0:IF BX$="" THE
       N PL=PL+1:GOSUB 910
BC 620 IF PC$(PL)="X" THEN 117
       0
PA 630 POKE V,CH:POKE V+C,14:O
       V=V:GOTO 100
SF 640 E=X:FOR K=1 TO 9:E=E-2:
       IF E=0 THEN GOSUB 1400:
       GOTO 100
GS 650 NEXT:GOTO 190
AE 660 PRINT"{CLR}":PRINT TAB(
       8)"{RVS}{RED} WELCOME T
       O CONNECT'EM ":PRINT:PR
       INT:GOSUB 1420
BD 670 TS=84:GOSUB 1410
HB 680 PRINT"{BLU}TO PLAY AGAI
       NST THE COMPUTER,":PRIN
       T"ENTER {RED}C-128{BLU}
        FOR"
MA 690 PRINT"EITHER OR BOTH PL
       AYER'S NAMES..":PRINT:P
       RINT:FOR T=1 TO 2500:NE
       XT
MG 700 FOR H=1 TO 2:GOSUB 1410
       :PRINT"{BLU}WHAT IS PLA
       YER #"H"{LEFT}'S NAME
       {RED}";:INPUT PL$(H)
PE 710 PL$(H)=LEFT$(PL$(H),8):
       NEXT:PRINT:PRINT:GOSUB
       {SPACE}1410:F1=3:F2=0
DG 720 PRINT:FOR T=1 TO 2:F1=F
       1+1:NC(T)=F1
PQ 730 NC(T)=F1+16*4:IF PL$(T)
       ="C-128" THEN F2=F2+1:P
       C$(T)="X"
BJ 740 IF T=2 AND F2=2 THEN PL
       $(T)="COMMODORE"
XH 750 Z$=LEFT$(PL$(T),1):A=AS
       C(Z$):FL(T)=A-64
DD 760 PRINT"{RED}{2 SPACES}";
       PL$(T);"{BLU} WILL USE
       {SPACE}JOYSTICK";T:NEXT
BR 770 L%=LEN(PL$(1)):M%=LEN(P
       L$(2)):L%=(L%/2)+7:M%=(
       M%/2)+23
MH 780 PRINT:PRINT:PRINT"{BLU}
       REGULAR OR MINI GAME (R
       /M)?"
KK 790 GET Z$:IF Z$="R" THEN 8
       20
DP 800 IF Z$<>"M" THEN 790
QA 810 LX=18:UX=7:TS=42
MC 820 FOR X=1 TO UX:DT$=DT$+"
       . ":NEXT
DC 830 GOSUB 1420:GOSUB 910:RE
       TURN
FF 840 IF TY$="N" THEN AA=ROW:
       BB=COL
QH 850 IF TY$="A" THEN AA=ROW-
       1:BB=COL
XJ 860 IF TY$="D" THEN AA=ROW:
       BB=COL-1
CC 870 A=(AA*2+7)-2:B=BB*2+4:E
       =S+A*40+B+41
RF 880 AA=FL(PL):CL=NC(PL)
DQ 890 POKE E,AA+128:POKE E+C,
       CL:CL=2:RETURN
MG 900 PRINT"{HOME}":FOR J=1 T
       O C1:PRINT:NEXT:RETURN
AR 910 IF IN$="" THEN BX$="":P
       RINT"{CLR}"
MB 920 PRINT"{HOME}":PRINT TAB
       (9)"{RVS}{BLU} CONNECT'
       EM SCOREBOARD ":PRINT
HG 930 IF BX$<>"X" THEN 960
RQ 940 IF PL=1 THEN P1=P1+1:GO
       TO 960
QD 950 P2=P2+1:PL=2
ER 960 PRINT TAB(8)"{RVS}{PUR}
       "+PL$(1);TAB(24)"{RVS}
       {GRN}"+PL$(2):IFPL>2 TH
       EN PL=1
KP 970 PRINT TAB(L%)"{PUR}";P1
       ;TAB(M%)"{GRN}"P2
PK 980 POKE RR,5:PRINT:FOR I=1
        TO 20:PRINT" ";:NEXT:N
       A$=PL$(PL):POKE CC,NC(P
       L)
HC 990 PRINT:PRINT"{UP}"TAB(4)
       NA$;"'S TURN":IF PC$(PL
       )=""THEN GOSUB 1410
FC 1000 IF IN$<>"" THEN 1030
KM 1010 IN$="X":C1=6:GOSUB 900
XB 1020 FOR X=1 TO 8:PRINT TAB
       (6)"{RED}";DT$:PRINT:N
       EXT:TI$="000000"
AH 1030 GOSUB 1160
MK 1040 A=P1+P2:IF A=TS THEN 1
       060
AD 1050 RETURN
BX 1060 WN$=" WINS!!":NA$=PL$(
       1)+WN$:IF P2=P1 THEN N
       A$="IT'S A TIE!!":GOTO
        1080
PP 1070 POKE CC,NC(1):IF P2>P1
        THEN NA$=PL$(2)+WN$:P
       OKE CC,NC(2)
SM 1080 C1=22:GOSUB 900
FA 1090 FOR X=1 TO 7:POKE RR,2
       1:PRINT:FOR I=1 TO 25:
       PRINT" ";:NEXT:PRINT:G
       OSUB 1420
RX 1100 PRINT TAB(12)"{UP}";NA
       $:FOR Y=1 TO 300:NEXT:
       NEXT
CQ 1110 PRINT TAB(7)"{RED}CARE
        TO PLAY AGAIN (Y/N)?"
AK 1120 GET Z$:IF Z$="" THEN 1
       120
BK 1130 IF Z$="N" THEN END
DB 1140 IF Z$<>"Y" THEN 1120
RF 1150 FOR A=1 TO 7:FOR B=1 T
       O 12:BX(A,B)=0:NEXT:NE
       XT:D1=0:D2=0:GOTO 50
PS 1160 PRINT"{HOME}":PRINT"
       {PUR}";LEFT$(TI$,2);":
       ";MID$(TI$,3,2);":";RI
       GHT$(TI$,2):RETURN
CJ 1170 NZ=0:VA=-1:NX=0:GOSUB
       {SPACE}1440
KQ 1180 VA=VA+1:NL=VA+1
HX 1190 IF BZ$(VA)="X" THEN 11
       80
FP 1200 FOR A=1 TO 7:FOR B=1 T
       O UX-1
PE 1210 IF BX(A,B)=3 THEN NZ=0
       :NL=4:NX=0:GOSUB 1340:
       A=7:B=UX-1:GOTO 1230
AS 1220 IF BX(A,B)=VATHEN GOSU
       B 1340
XQ 1230 NEXT:NEXT:NX=0:IF NZ>0
        GOTO 1250
KH 1240 BZ$(VA)="X":GOTO 1180
CH 1250 R=INT(RND(1)*NZ)+1:IF
       {SPACE}NX=NZ THEN NZ=0
       :GOTO 1180
AS 1260 IF ZO(R)=99 THEN 1250
MC 1270 NX=NX+1:LOC=ZO(R)
QG 1280 FOR Z=1 TO 4:RX$(Z)=""
       :NEXT:RX=0
JA 1290 IF RX=4 THEN ZO(R)=99:
       GOTO 1250
PQ 1300 Z=INT(RND(1)*4)+1:IF R
       X$(Z)="X" THEN 1300
PA 1310 RX=RX+1:RX$(Z)="X"
EK 1320 E=PEEK(LOC+ZX(0,Z)):IF
        E=32 THEN GOSUB 1350:
       GOTO 1380
EK 1330 GOTO 1290
BQ 1340 E=(A*2+7)-2:K=B*2+4:LO
       C=S+E*40+K:NZ=NZ+1:ZO(
       NZ)=LOC:RETURN
CR 1350 XX=LOC-S:FOR K=1 TO 21
       :XX=XX-40:YY=XX:IF YY<
       40 THEN XX=K:K=21
MH 1360 NEXT
```

```
FX 1370 ROW=(XX-7)/2+1:COL=(YY
        -6)/2+1:RETURN
QE 1380 IF BX(ROW+ZX(Z,1),COL+
        ZX(Z,2))<NL THEN D1=LO
        C+ZX(Z,3):D2=LOC+ZX(Z,
        4):GOTO 310
GQ 1390 GOTO 1290
PG 1400 VOL 5:SOUND 1,0,10:RET
        URN
JF 1410 FOR I=5 TO 0 STEP-1:VO
        L I:SOUND 2,929,10:NEX
        T:RETURN
DH 1420 VOL 5:SOUND 2,979,2:FO
        R A=1 TO 4:F1=850:FOR
        {SPACE}B=1 TO 2:F2=102
        2:SOUND 1,F1,2:FOR K=1
         TO 2
QS 1430 SOUND 2,F2,2:F1=F1*1.0
        5:F2=F2*.9:NEXT K,B,A:
        RETURN
EF 1440 FOR Z=1 TO 15:A=INT(10
        *RND(1))+1
RM 1450 Q=INT(25*RND(1))+1:VOL
        5:SOUND 1,664,4:F2=INT
        (797*RND(1))+1
HC 1460 SOUND 2,F2,4:FOR T=1 T
        O Q:NEXT T,Z:RETURN
PF 1470 VOL 5:SOUND 2,979,.5:F
        OR Z=1 TO 4:FOR F1=102
        2 TO 0 STEP-24:SOUND 1
        ,F1,.5:NEXT F1
KG 1480 FOR F1=0 TO 1022 STEP
        {SPACE}40:SOUND 1,F1,.
        5:NEXT F1:RETURN
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Power BASIC: Information Please

Article on page 101.

```
GF 10 PRINT"{CLR}{2 DOWN}{WHT}
      READING DATA":CK=0:FORI=
      49152TO49423:READD:POKEI
      ,D:CK=CK+D:NEXT
RE 20 IFCK<>30932THENPRINT"ERR
      OR IN DATA STATEMENTS":E
      ND
QP 30 PRINT"{CLR}{2 DOWN}DISK
      {SPACE}OR TAPE (D/T) ";:
      INPUTA$
RB 40 IFLEFT$(A$,1)="T"THENDV$
      ="PREPARE TAPE":DV=1:GOT
      O70
GD 50 IFLEFT$(A$,1)="D"THENDV$
      ="INSERT DISK":DV=8:GOTO
      70
XE 60 GOTO30
ED 70 PRINT"{DOWN}"DV$", THEN
      {SPACE}PRESS {RVS}RETURN
      "
EG 80 GETA$:IFA$<>CHR$(13)THEN
      80
DD 90 PRINT"{DOWN}WRITING FILE
XP 100 F$="INFO PLEASE":POKE25
      1,PEEK(71):POKE252,PEEK
      (72)
CH 110 AD=PEEK(251)+PEEK(252)*
      256:POKE183,PEEK(AD):PO
      KE187,PEEK(AD+1)
BR 120 POKE188,PEEK(AD+2):POKE
      184,DV:POKE186,DV:POKE1
      85,1
DJ 130 POKE251,0:POKE252,192:P
      OKE780,251:POKE781,16:P
      OKE782,193:SYS65496
GE 140 PRINT"{CLR}{2 DOWN} INF
      O PLEASE FILE CREATED":
      END
JS 150 DATA 169,181,160,192,32
      ,30,171,169,0,133,253,1
      33,254,165,43,133
BX 160 DATA 251,165,44,133,252
      ,160,0,177,251,72,200,1
      77,251,240,13,133
HG 170 DATA 252,104,133,251,23
      0,253,208,237,230,254,2
      08,233,104,165,254,166
EH 180 DATA 253,32,160,192,56,
      165,45,229,43,170,165,4
      6,229,44,32,160
DC 190 DATA 192,56,165,47,229,
      45,170,165,48,229,46,32
      ,160,192,56,165
AE 200 DATA 49,229,47,170,165,
      50,229,48,32,160,192,32
      ,38,181,56,165
MX 210 DATA 55,229,51,133,253,
      170,165,56,229,52,133,2
      54,32,160,192,56
DP 220 DATA 165,55,229,43,170,
      165,56,229,44,32,160,19
      2,56,165,49,229
PQ 230 DATA 43,170,165,50,229,
      44,168,24,138,101,253,1
      70,152,101,254,32
PD 240 DATA 160,192,56,165,51,
      229,49,170,165,52,229,5
      0,32,160,192,96
RE 250 DATA 72,138,72,169,9,13
      3,211,32,108,229,104,17
      0,104,32,205,189
ES 260 DATA 169,13,76,210,255,
      13,13,76,73,78,69,83,46
      ,46,46,46
AB 270 DATA 13,80,82,79,71,82,
      65,77,46,46,13,86,65,82
      ,73,65
EQ 280 DATA 66,76,69,46,13,65,
      82,82,65,89,46,46,46,46
      ,13,83
GM 290 DATA 84,82,73,78,71,46,
      46,46,13,77,69,77,79,82
      ,89,46
AR 300 DATA 46,46,13,85,83,69,
      68,46,46,46,46,46,13,70
      ,82,69
HF 310 DATA 69,46,46,46,46,46,
      13,145,145,145,145,145,
      145,145,145,0
```

Icon Changer For *GEOS*

Article on page 84.

```
GS 10 POKE53281,0:POKE53280,0:
      POKE53269,0:DN$="":IU=0
ER 20 PRINT"{CLR}{RED}{DOWN}"S
      PC(12)"{RVS} ICON CHANGER
      "
KB 30 PRINT"{DOWN}{4}ENTER THE
       FILENAME OF THE ICON YO
      U WANT TO CHANGE{DOWN}"
JB 40 INPUT IN$
EK 50 PRINT"{DOWN}FILENAME SEL
      ECTED IS >{RED}"IN$"{4}<
      ":PRINT"{DOWN}IS THIS CO
      RRECT";
KR 60 INPUT" Y/N";AN$:IF AN$<>
      "Y"THEN10
EQ 70 FORCT=1TO16:PD$=PD$+CHR$
      (32):NEXT:IN$=LEFT$(IN$+
      PD$,16)
ME 80 OPEN15,8,15,"I0"
GP 90 INPUT#15,ER$,EM$:IFER$<>
      "00"THENPRINTER$+" "+EM$
      :CLOSE15:END
DS 100 T=18:S=1
DX 110 OPEN2,8,2,"#"
DM 120 PRINT#15,"U1";2;0;T;S:F
      C=0:FP=2:BP=5
AA 130 PRINT#15,"B-P";2;0:GET#
      2,NT$,NS$:T=ASC(NT$+CHR
      $(0)):S=ASC(NS$+CHR$(0)
      )
RB 140 PRINT#15,"B-P";2;FP:GET
      #2,FT$:FT$=FT$+CHR$(0):
      IFASC(FT$)=0THEN280
GP 150 PRINT#15,"B-P";2;BP
MP 160 FORCT=1TO16
XM 170 GET#2,BI$
AP 180 IFBI$=""THENBI$=CHR$(0)
MK 190 FI=ASC(BI$)
RE 200 IFFI>127THENFI=FI-128
HX 210 IFFI<32THENFI=63
FX 220 IFFI>96ANDFI<123THENFI=
      FIAND223
PQ 230 IFFI=34THENFI=63
FC 240 DN$=DN$+CHR$(FI)
BB 250 NEXTCT
ED 260 IFDN$=IN$THEN310
AK 270 DN$=""
KR 280 FC=FC+1:IFFC=8ANDT<>0TH
      EN120
QE 290 IFFC=8ANDT=0THEN560
HJ 300 FP=FP+32:BP=BP+32:GOTO1
      40
GH 310 GET#2,IT$,IS$
BG 320 IT=ASC(IT$+CHR$(0)):IS=
      ASC(IS$+CHR$(0))
FM 330 PRINT#15,"U1";2;0;IT;IS
MG 340 PRINT#15,"B-P";2;5
EF 350 FORCT=1TO63:GET#2,ID$:I
      D=ASC(ID$+CHR$(0)):POKE
      831+CT,ID:NEXT
EA 360 POKE53269,1:POKE2040,13
      :POKE53287,11:POKE53248
      ,110:POKE53249,147
GR 370 POKE53249,147
AR 380 PRINTSPC(15)"{2 DOWN}
      {BLU}<- CURRENT ICON"
MJ 390 RESTORE:FORCT=1TO63
JQ 400 READNI:POKE895+CT,NI
EE 410 NI$=NI$+CHR$(NI)
PQ 420 NEXTCT
FC 430 POKE53269,3:POKE2041,14
      :POKE53288,11:POKE53250
      ,110:POKE53251,180
FF 440 PRINTSPC(15)"{3 DOWN}
      {RED}<- NEW ICON"
BD 450 IFIU=0THENPRINT"
      {2 DOWN}{4}PROCEED WITH
       CHANGE";
EM 460 IFIU=0THENINPUT" Y/N";A
      N$:IF AN$<>"Y"THEN GOTO
      550
XK 470 IFIU=0THENPRINT#15,"B-P
      ";2;5
EH 480 IFIU=0THENPRINT#2,NI$;
XJ 490 IFIU=0THENPRINT#15,"U2"
      ;2;0;IT;IS
MC 500 IFIU=0THENIU=1:PRINT"
      {11 UP}":GOTO330
MH 510 PRINT"{2 DOWN}{4}CHANGE
       COMPLETED{13 SPACES}":
      CLOSE2:CLOSE15
XM 520 PRINT"{DOWN}DO YOU WANT
       TO CHANGE ANOTHER ICON
       TO{3 SPACES}THIS PATTE
      RN";
QP 530 INPUT" Y/N";A$:IFA$="Y"
```

```
      THEN10
DF 540 CLOSE2:CLOSE15:POKE5326
      9,0:END
AF 550 CLOSE2:CLOSE15:POKE5326
      9,0:PRINT"{CLR}":PRINTS
      PC(13)"CHANGE ABORTED":
      END
SM 560 PRINT"{DOWN}FILE NOT FO
      UND":CLOSE2:CLOSE15:END
GG 570 REM ** ICON DATA **
HC 580 REM ** GEOPAINT ICON **
JA 590 DATA 255,255,255,146,73
      ,1,255,255,125,168,0,1,
      248,31,141,168
XD 600 DATA 32,81,248,64,33,16
      8,64,225,248,131,17,171
      ,255,253,248,136
HX 610 DATA 17,168,112,33,248,
      64,33,169,160,65,250,31
      ,129,136,0,1
XK 620 DATA 255,255,255,136,6,
      129,136,4,189,136,4,129
      ,255,255,255,227
CG 630 REM ** GEOWRITE ICON **
HC 640 DATA 255,255,255,146,73
      ,1,255,255,125,170,170,
      171,255,255,255,128
MC 650 DATA 0,1,129,94,129,129
      ,170,129,128,0,1,133,25
      1,117,128,0
PP 660 DATA 1,191,215,221,128,
      0,1,190,237,181,128,0,1
      ,189,181,253
MC 670 DATA 128,0,1,187,124,1,
      128,0,1,134,245,189,255
      ,255,255,35
EG 680 REM ** GEOWRITE APPLICA
      TION ICON #1**
RJ 690 DATA 255,255,255,216,0,
      31,252,0,31,129,188,31,
      129,94,1,129
BA 700 DATA 235,1,128,0,1,128,
      0,1,128,0,1,255,255,255
      ,128,0
JJ 710 DATA 1,255,255,255,224,
      0,7,159,0,249,128,255,1
      ,129,0,129
KD 720 DATA 134,0,97,136,0,17,
      176,0,13,192,0,3,255,25
      5,255,98
FM 730 REM ** GEOWRITE APPLICA
      TION ICON #2**
XK 740 DATA 31,255,248,64,0,2,
      0,15,0,128,127,129,131,
      255,1,143
GJ 750 DATA 254,1,176,127,65,1
      28,254,177,131,184,1,14
      2,16,1,128,12
DM 760 DATA 1,143,255,241,128,
      0,1,136,146,129,141,170
      ,129,138,186,129
AF 770 DATA 136,170,241,128,0,
      1,15,255,240,64,0,2,31,
      255,248,251
JM 780 REM ** GEOPAINT APPLICA
      TION ICON **
FR 790 DATA 255,255,255,128,0,
      1,145,17,1,185,17,1,190
      ,170,253,184
MM 800 DATA 68,1,144,68,1,144,
      0,1,144,80,1,144,80,1,1
      84,80
KQ 810 DATA 1,191,223,253,184,
      80,1,144,80,1,144,80,1,
      144,3,255
HF 820 DATA144,2,1,144,2,245,1
      44,2,189,128,2,1,255,25
      5,255,34
```

Keyword Construction Set

Article on page 56.

```
HP 10 PRINT"{CLR}{CYN}":POKE53
      280,6:POKE53281,6:PRINT"
      KEYBOARD CONSTRUCTION SE
      T{8}{2 DOWN}"
HM 20 N=41117:M=49221:PRINT"EN
      TER NEW LANGUAGE NAME":I
      NPUT B$
JA 30 PRINT"{2 DOWN}PRINTER (Y
      /N)?";
ED 40 GETA$:IFA$=""THEN40
QH 50 IFA$="Y"THENGOSUB200
AX 60 X$="":IFN>=41372THEN90
XH 70 N=N+1:X=PEEK(N):IFX<128T
      HENX$=X$+CHR$(X):GOTO70
CQ 80 X$=X$+CHR$(X-128):LN=LEN
      (X$):GOSUB210:GOTO60
RD 90 IFRT>0 THEN PRINT"{DOWN}
      TABLE TOO LONG":FOR I=1
      {SPACE}TO 1500:NEXT:RUN
DQ 100 CLOSE4:POKEM,0:FORI=491
      52TO49220:READA:POKEI,A
      :F=F+A:NEXT
RM 110 IFF<>10293THENPRINT"ERR
      OR IN DATA STATEMENTS."
      :STOP
RE 120 PRINT"{2 DOWN}{RVS}{8}T
      {OFF}{CYN}APE/{RVS}{8}D
      {OFF}{CYN}ISK?";
MD 130 GETA$:IFA$=""ORA$<>"D"A
      NDA$<>"T"THEN130
RK 140 DV=1-7*(A$="D"):IFDV=8T
      HENB$="0:"+B$
HS 150 F$=B$:POKE780,LEN(F$):A
      =PEEK(53)+256*PEEK(54)-
      LEN(F$):POKE782,A/256
GX 160 POKE781,A-256*PEEK(782)
      :SYS65469:POKE780,1:POK
      E781,DV:POKE782,PEEK(78
      0)
FK 170 SYS65466:POKE 251,0:POK
      E252,192:POKE781,69:POK
      E782,193:POKE780,251:SY
      S65496
DD 180 PRINT:PRINT"{DOWN}LOAD"
      CHR$(34)B$CHR$(34)",8,1
      -{2 SPACES}NEW
      {2 SPACES}-{2 SPACES}SY
      S49152"
FC 190 END
PF 200 P=1:OPEN4,4:PRINT#4,"BA
      SIC{9 SPACES}"B$:PRINT#
      4:RETURN
EJ 210 N1=N-41117:PRINT"{CLR}
      {8}TOTAL BYTES="N1" OVE
      R/UNDER (+/-)="RT
MA 220 A$=X$:PRINT"{DOWN}{3}"X
      $TAB(10)"{CYN}";:INPUTA
      $:IFA$=X$THENPRINTA$
EG 230 LA=LEN(A$):D=LA-LN:RT=R
      T+D
XD 240 FORI=1TOLA:POKEM,ASC(MI
      D$(A$,I,1)):M=M+1:NEXT:
      POKEM-1,PEEK(M-1)+128
RH 250 IFPTHENPRINT#4,X$;:FORI
      =1TO15-LEN(X$):PRINT#4,
      " ";:NEXT:PRINT#4,A$
CG 260 RETURN
FG 270 DATA 169,0,133,251,169,
      160,133,252,160,0
FK 280 DATA 162,32,177,251,145
      ,251,200,208,249,230
FQ 290 DATA 252,202,208,244,16
      9,69,141,189,165,141
CX 300 DATA 0,166,141,49,167,1
      41,57,167.169,192
GF 310 DATA 141,190,165,141,1,
      166,141,50,167,141
XM 320 DATA 58,167,169,68,141,
      251,165,169,192,141
AD 330 DATA 252,165,165,1,41,2
      54,133,1,96
```

Data-Aid

See instructions in article on page 92 before typing in.

```
C000:A9 16 8D 08 03 A9 C0 20 6E
C008:68 C2 A9 0F 8D 18 D4 A9 B4
C010:E0 8D 06 D4 60 00 20 73 2A
C018:00 C9 21 F0 03 4C E7 A7 FF
C020:20 26 C0 4C E4 A7 20 73 91
C028:00 C9 43 D0 03 4C 64 C0 64
C030:C9 52 D0 03 4C A2 C0 C9 AD
C038:42 D0 03 4C 9D C2 C9 44 04
C040:D0 03 4C 00 C1 C9 53 D0 21
C048:03 4C 00 C2 C9 4D D0 03 B2
C050:4C 00 C3 C9 5A F0 01 60 06
C058:A9 E4 A2 A7 8D 08 03 8E D7
C060:09 03 60 00 20 73 00 20 22
C068:8A AD 20 F7 B7 A6 14 8E 2D
C070:20 D0 20 FD AE 20 8A AD D2
C078:20 F7 B7 A6 14 8E 21 D0 57
C080:20 FD AE 20 8A AD 20 F7 AC
C088:B7 A6 14 BD 92 C0 20 D2 98
C090:FF 60 90 05 1C 9F 9C 1E 43
C098:1F 9E 81 95 96 97 98 99 B8
C0A0:9A 9B 20 73 00 20 8A AD D4
C0A8:20 F7 B7 A5 14 8D C3 C0 A8
C0B0:A5 15 8D CA C0 A9 00 8D E2
C0B8:E9 C0 A9 08 8D EA C0 20 CE
C0C0:DF C0 E0 65 D0 F9 20 DF 63
C0C8:C0 E0 00 D0 F2 20 DF C0 88
C0D0:E0 83 D0 EB AD E9 C0 85 98
C0D8:41 AD EA C0 85 42 60 EE B4
C0E0:E9 C0 D0 04 18 EE EA C0 F4
C0E8:AE FE 0A 60 00 50 4F 4B F3
C0F0:45 32 35 33 2C BF 87 68 53
C0F8:00 00 00 90 40 FD 00 00 7D
C100:20 73 00 20 8A AD 20 F7 B5
C108:B7 A6 14 86 FD 20 FD AE 17
C110:20 8A AD A2 F6 A0 C0 20 02
C118:D4 BB 20 FD AE 20 8A AD 91
C120:A2 FB A0 C0 20 D4 BB A9 89
C128:B9 8D 02 03 A9 C1 8D 03 CE
C130:03 90 05 81 00 00 00 00 12
C138:A9 F6 A0 C0 20 A2 BB A9 1B
C140:33 A0 C1 20 67 B8 A2 F6 1A
C148:A0 C0 20 D4 BB 20 DD BD 75
C150:A2 00 BD 00 01 F0 06 9D 52
C158:FF 01 E8 D0 F5 A9 B5 85 8D
C160:19 A9 C1 85 1A A0 00 B1 70
C168:19 9D FF 01 E8 C8 C0 04 DF
C170:D0 F5 A9 10 85 FC 86 02 3F
C178:A9 FB A0 C0 20 A2 BB A9 9C
C180:33 A0 C1 20 67 B8 A2 FB 5F
C188:A0 C0 20 D4 BB 20 0D B8 0F
C190:20 DD BD A6 02 A0 01 B9 0C
C198:00 01 F0 07 9D FF 01 E8 C2
C1A0:C8 D0 F4 A9 2C 9D FF 01 CE
C1A8:E8 C6 FC D0 C9 CA CA 20 2E
C1B0:CA AA 20 86 A4 44 41 54 BD
C1B8:41 C6 FD F0 03 4C 38 C1 D8
C1C0:A9 83 8D 02 03 A9 A4 8D 61
C1C8:03 03 4C 74 A4 F3 7F E3 37
C1D0:08 F7 00 F7 08 53 FF F7 5B
C1D8:A5 FC 8D 00 D4 A5 FD 8D E6
C1E0:01 D4 A9 11 8D 04 D4 A0 27
C1E8:00 A2 00 E8 D0 FD C8 D0 84
C1F0:F8 A9 00 8D 04 D4 60 00 68
C1F8:00 00 00 00 00 00 00 00 7C
C200:20 A2 C0 20 73 00 20 8A BE
C208:AD 20 F7 B7 A6 7A A4 7B CA
C210:86 43 84 44 A5 41 85 7A 36
C218:A5 42 85 7B 20 79 00 C9 1A
C220:83 F0 07 20 73 00 C9 83 39
C228:D0 F9 20 73 00 C9 2C F0 40
```

```
C230:F9 C9 2D F0 29 20 9E B7 98
C238:8A A0 00 91 14 E6 14 D0 79
C240:02 E6 15 20 79 00 C9 00 84
C248:D0 E0 A0 01 B1 7A C9 00 9D
C250:F0 0C 20 73 00 20 73 00 F3
C258:20 73 00 18 90 C5 A6 43 78
C260:A4 44 86 7A 84 7B 60 00 94
C268:8D 09 03 EA A2 18 BD 82 79
C270:C2 20 D2 FF CA D0 F7 A9 EC
C278:06 8D 21 D0 A9 06 8D 20 36
C280:D0 60 20 44 45 54 41 56 23
C288:49 54 43 41 20 44 49 41 2A
C290:2D 41 54 41 44 20 20 20 9E
C298:9F 93 08 00 00 20 73 00 3B
C2A0:18 E9 40 AA BD C9 C2 85 7F
C2A8:FC A9 01 85 FD 20 73 00 E6
C2B0:18 E9 2F AA 18 06 FD 26 48
C2B8:FC 90 02 E6 FD CA D0 F4 41
C2C0:4C D8 C1 00 00 00 00 00 DA
C2C8:00 C3 FA 0C 2D 51 66 91 6C
C2D0:20 44 E5 20 73 00 C9 00 65
C2D8:D0 03 4C 74 A4 20 73 00 E4
C2E0:20 73 00 AA 20 73 00 20 EC
C2E8:CD BD 60 00 C9 40 30 02 82
C2F0:E9 40 60 AA BD FD C2 8D 2B
C2F8:8B C3 B5 FC 60 40 41 42 84
C300:20 A2 C0 EA A9 93 20 D2 B5
C308:FF A6 7A A4 7B 86 43 84 D3
C310:44 A5 41 85 7A A5 42 85 18
C318:7B 20 AE C3 A0 20 84 FC 03
C320:84 FD 84 FE 20 73 00 C9 82
C328:00 F0 17 C9 2C D0 03 4C 62
C330:4D C3 20 EC C2 A6 FD 86 55
C338:FC A6 FE 86 FD 85 FE 18 4C
C340:90 E2 20 D0 C2 20 73 00 57
C348:C9 83 D0 F9 EA A9 FF 48 95
C350:A9 02 48 A9 01 48 A9 00 4D
C358:48 68 C9 FF D0 03 4C E0 63
C360:C3 20 F3 C2 A8 A2 FF 8E DA
C368:88 C3 A2 CF 8E 89 C3 18 B0
C370:AD 88 C3 69 08 90 03 EE 77
C378:89 C3 8D 88 C3 88 D0 EF C1
C380:A2 08 A0 24 20 9A C3 BD 62
C388:97 D1 99 42 03 88 88 88 7B
C390:CA D0 F4 20 A4 C3 18 90 47
C398:C0 00 A9 00 8D 0E DC A9 BD
C3A0:33 85 01 60 A9 37 85 01 7F
C3A8:A9 01 8D 0E DC 60 A9 0D A0
C3B0:8D F8 07 A9 01 8D 15 D0 F1
C3B8:8D 27 D0 8D 17 D0 8D 1D F7
C3C0:D0 A9 80 8D 00 D0 8D 01 63
C3C8:D0 A9 05 20 D2 FF EA 8D BF
C3D0:21 D0 A9 00 A0 45 99 39 D8
C3D8:03 88 D0 FA 8D 1C D0 60 AC
C3E0:20 CF FF C9 0D D0 03 4C 07
C3E8:1C C3 C9 5F D0 0E A9 00 B0
C3F0:8D 15 D0 20 18 E5 20 5E 97
C3F8:C2 4C 74 A4 18 90 E1 D7 6C
C400:FF 00 00 00 00 00 00 00 89
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Mastering 128 Sound and Music

Article on page 58.

Program 1: 128 Sound and Music—Saints

```
PD 10 VOL 8:TEMPO 15:PLAY"X0"
JP 20 CF=800:LP=1:BP=0:HP=0:RE
      S=15
RP 30 ENVELOPE 8,3,0,9,3,2,384
EF 40 ENVELOPE 0,0,9,0,0,0
AP 50 A$="V1O4QCQEQFQGV3O3QC"
DX 60 B$="V3O3QGV2O4QEV1O5QCQC
      V3O3QFO4QCV2QFV1QAO5QCV3
      O3QC"
EK 70 C$="V3O3QEV2QGV1O4QCQEV3
      O2QGO3QGV2QBV1O4QFQGV3O3
      QC"
JX 80 D$=B$
QA 90 E$="V3O3QEV2QGV1O4QCQEV3
      O2QGO3QGV2QBV1O4QFHGV3O3
      QC"
AH 100 F$="V3O4QCV2QEV3O3QGV1O
       4HEV3O3QGV2O4QCV3O3QCV1
       O4HCV3O3QEV2QGV3O3QGV1O
       4HEV3O3QGV2O4QCV3O3QGV1
       O4QD"
EX 110 G$="V1O5QCV3O4QEV2QGV3O
       3QDV1O4QBQAV3O3QBV2O4QF
       V3O3QDV1O4QGQFV3O3QGV2Q
       BV3O3QGV1O4QEQDV3O3QGV2
       QB"
PJ 120 GOSUB280
HK 130 GET X$
ED 140 IF X$="C" THEN GO TO 37
       0
PA 150 IF X$="L" THEN LP=ABS(L
       P-1):GO TO 120
DC 160 IF X$="B" THEN BP=ABS(B
       P-1):GO TO 120
AH 170 IF X$="H" THEN HP=ABS(H
       P-1):GO TO 120
PX 180 IF X$="R" THEN GO TO 40
       0
AS 190 IF X$="P" THEN GO TO 21
       0
JS 200 GO TO 130
QJ 210 FILTER CF,LP,BP,HP,RES
JM 220 PLAY"V1T8X0V2T0X0V3T0X0
       "
AJ 230 PRINT"{2 DOWN}"
GB 240 GOSUB 430:PLAY A$:GOSUB
        450:PLAY B$:GOSUB 430:
       PLAY C$
AS 250 GOSUB 450:PLAY D$:GOSUB
        430:PLAY E$:PLAY F$:GO
       SUB 450:PLAY G$
MC 260 GO TO 120
GH 270 END
BJ 280 PRINT"{CLR}{TAB}
       {4 SPACES}{RVS}C-128 SI
       D FILTER{2 DOWN}"
GH 290 PRINT"{2 SPACES}{RVS}CU
       TOFF{OFF}{4 SPACES}
       {RVS}LP{TAB}{OFF}
       {3 SPACES}{RVS}BP{TAB}
       {OFF}{2 SPACES}{RVS}HP
       {TAB}{2 LEFT}RESONANCE"
DC 300 PRINT USING "#######";C
       F,LP,BP,HP,RES
AJ 310 PRINT"{DOWN}PRESS {RVS}
       C{OFF} TO CHANGE CUTOFF
        FREQUENCY"
SD 320 PRINT"{DOWN}PRESS {RVS}
       L{OFF} TO SWITCH LOW-PA
       SS FILTER"
AS 330 PRINT"{DOWN}PRESS {RVS}
       B{OFF} TO SWITCH BAND-P
       ASS FILTER"
BP 340 PRINT"{DOWN}PRESS {RVS}
       H{OFF} TO SWITCH HIGH-P
       ASS FILTER"
QA 350 PRINT"{DOWN}PRESS {RVS}
       R{OFF} TO CHANGE RESONA
       NCE"
GH 360 PRINT"{DOWN}PRESS {RVS}
       P{OFF} TO PLAY":RETURN
BD 370 INPUT"{DOWN}CUTOFF FREQ
       UENCY (0-2047)";CF
BD 380 IF CF<0 OR CF>2047 THEN
        GO TO 370
DM 390 GO TO 120
AC 400 INPUT"{DOWN}RESONANCE (
       0-15)";RES
GJ 410 IF RES<0 OR RES>15 THEN
        GO TO 400
AP 420 GO TO 120
QF 430 PLAY "V1X0"
JQ 440 PRINT"{UP}{TAB}{RVS}
       {7 SPACES}{OFF}FILTER O
       FF{RVS}{7 SPACES}{OFF}"
       :RETURN
JP 450 PRINT"{UP}{TAB}
       {7 SPACES}{RVS}FILTER O
       N{OFF}{8 SPACES}"
MP 460 PLAY "V1X1":RETURN
```

Program 2: 128 Sound and Music—Joy

```
KR 10 REM JOY
RF 20 PRINT"{CLR}{5 DOWN}
      {6 SPACES}JESU, JOY OF M
      AN'S DESIRING"
FB 30 PRINT"{5 DOWN}{2 TAB}
      {3 SPACES}BY"
HH 40 PRINT"{5 DOWN}{TAB} JOHA
      NN SEBASTION BACH"
AR 50 BANK 15
XM 60 TEMPO 10
CS 70 VOL 8
PX 80 ENVELOPE 8,3,1,12,6,2,20
      0
CF 90 FILTER 0,1,0,0,7
CK 100 PLAY"V1U9T8X0V2T8X0V3T7
       X1"
XB 110 A$="V3O1.QGV1IRO4IGIAIB
       V2QDV3O2.QGV1O5IDICV2O4
       I#FQGV3O2.QEV1O5ICIEIDV
       2O4IA"
SS 120 B$="V2O4QGV3O1.QBV1O5ID
       IGI#FV2O4IAQBV3O2.QEV1O
       5IGIDO4IBV2IGO3QBV3O1.Q
       EV1O4IGIAIBV2ID"
RS 130 C$="V2O4QEV3O1.QAV1O5IC
       IDIEV2O4I#FQGV3O1.QBV1O
       5IDICO4IBV2IDQEV3O2.QCV
       1O4IAIBIGV2O3IB"
HE 140 D$="V2O4QCV3O2.QDV1O4I#
       FIGIAV2IDO3QAV3O2.Q#FV1
       O4IDI#FIAV2IGQ#FV3O2.QD
       V1O5ICO4IBIAV2I#F"
PH 150 VOL 7:PLAY A$:PLAY B$:P
       LAY C$:PLAY D$
HR 160 E$="V2O4QDV3O2.QGV1O4IB
       IGIAV2I#FQGV3O2.QEV1O4I
       BO5IDICV2O4I#FQEV3O2.QC
       V1O5ICIEIDV2O4IA"
SD 170 F$="V2O4QGV3O1.QBV1O5ID
       IGI#FV2O4IAQBV3O2.QEV1O
       5IGIDO4IBV2IGO3QBV3O2.Q
       DV1O4IGIAIBV2IG"
MS 180 G$="V2O4QAV3O2.QCV1O4IE
       O5IDICV2O4I#FQEV3O2.Q#C
       V1O4IBIAIGV2IEO3QAV3O2.
       QDV1O4IDIGI#FV2IC"
RE 190 H$="V2O3QBV3O1HGV1O4IGI
       BO5IDV2O4IGQBV1O5IGIDO4
```

```
        IBV2IDV3O3IGQDV2QBV1O4I
        GIBO5IDV2O4IGV3O2IB"
SS 2ØØ PLAY E$:PLAY F$:PLAY G$
        :PLAY H$
JE 21Ø I$="V3T7XØO1.QGV2T7O4.H
        DV1T7.HBV3O3.Q#F.QEV2O4
        .QGV1O5.QC"
SD 22Ø J$="V1O5.HDV2O4.QAV3O3.
        Q#F.QEV2O4.QG.Q#FV3O3.Q
        DV1O5.QD"
JA 23Ø K$="V1.HCV2O4.QGV3O3.QE
        .Q#FV2O4.HDV3O3.QGV1O4.
        QB"
BM 24Ø L$="V1O4IAV2Q#FV3O3QDV1
        T8O4IDIEI#FV2T8O3QAV3T7
        X1QDV1O4IAIGV2IEV3O2IDQ
        DV2O4Q#FV1IAO4ICO4IBV2I
        GV3O3ID"
RP 25Ø VOL 11:PLAY I$:PLAY J$:
        PLAY K$:PLAY L$
JJ 26Ø M$="V3O1HDV2O4Q#FV1O5IC
        O4IAI#FIDI#FIAV2IDV3O3I
        DQDV2QAV1O5ICO4IBIAV2I#
        FV3O3ID"
FD 27Ø N$="V3O3.QGV2O4.QDV1IBI
        GIAIBV2QGV3O3.Q#FV1O5ID
        ICV2O4I#FQGV3O3.QEV1O5I
        CIEIDV2O4IA"
DS 28Ø O$="V1O5IDV3O2.QBV2O4QG
        V1O5IGI#FV2O4IAQGV3O1.Q
        BV1O5IGIDO4IBV2I#FQEV3O
        3.QBV1O4IAIBV2IG"
FF 29Ø P$="V2O4QAV3O3.QCV1O4IE
        O5IDICV2O4IGQ#FV3O3.QDV
        1O4IBIAIGV2IEQCV3O2.QDV
        1O4IDIGI#FV2IC"
ED 3ØØ PLAY M$:PLAY N$:PLAY O$
        :PLAY P$
KB 31Ø Q$="V2O3.QBV3O2.QGV1O4I
        GIBIAIBV2.QDV3O3.QGV1O5
        IDICICV2O4QGV3O3.QEV1O5
        IEIDV2O4IA"
HP 32Ø R$=B$
SR 33Ø S$=C$
FS 34Ø T$=D$
CC 35Ø VOL 7:PLAY Q$:PLAY R$:P
        LAY S$:PLAY T$
KB 36Ø U$=E$
SC 37Ø V$=F$
HD 38Ø W$=G$
FF 39Ø X$=I$
DM 4ØØ PLAY U$:PLAY V$:PLAY W$
        :VOL 3:PLAY X$
FG 41Ø Y$=J$
MJ 42Ø Z$=K$
DG 43Ø AA$="V1O4I#FV2.QAV3O3QD
        V1T8O4IDIEI#FV3T7X1O3QD
        V1O4IAIGV2T8IEV3O2IDQDV
        2O4Q#FV1IAO4ICO4IBV2IGV
        3O3ID"
MG 44Ø AB$=M$
FJ 45Ø PLAY Y$:PLAY Z$:PLAY AA
        $:PLAY AB$
XQ 46Ø AC$="V3O3.QGV2T7O4.HBV1
        IDIGIAIGV3O3.Q#FV1O5IDI
        CO4IGV2O5.QCV3O3.QEV1O5
        IEID"
CM 47Ø AD$="V1O4IGV2O5.HDV3O2.
        QBV1O5IGI#FIGV3O3.QBV1O
        5IDO4IBIGV2.QBV3O3.QEV1
        O4IAIB"
PD 48Ø AE$="V1O4IEV2.IAV3O3.QC
        V1O5IDV2O4.SBV1O5ICV2.S
        CO4.QBV1I#FV3O3.QDV1O4I
        AIGIDV3O3.QDV2O4.QAV1IG
        I#F"
QS 49Ø AF$="V1O3IBV2O4.HGV3O2.
        QGV1O4IBIAIBV3O3.QGV1O5
        IDICICV3O3.QEV2T8O4QGV1
        O5IEIDV2O4IA"
FM 5ØØ PLAY AC$:PLAY AD$:PLAY
        {SPACE}AE$:PLAY AF$
JG 51Ø AG$=B$
HH 52Ø AH$=C$
SK 53Ø AI$=D$
FM 54Ø AJ$=E$
JF 55Ø PLAY AG$:PLAY AH$:PLAY
        {SPACE}AI$:PLAY AJ$
JR 56Ø AK$=F$
HS 57Ø AL$=G$
EQ 58Ø AM$="V2O3QBV3O1HGV1O4IG
        IBO5IDV2O4IG.QBV1O5IGID
        O4IBV3O3IGQ#FV2O4QDV1O4
        IGIBO5I#CV2O4IGV3O3IE"
KB 59Ø AN$="V3T7O3.QDV2T7O4.Q#
        FV1O5IDO4IDIEI#FV2.QDV3
        O3.QCV1O4IAI#GI#GV3O2.Q
        BV2O4.QDV1IBIA"
KF 6ØØ PLAY AK$:PLAY AL$:PLAY
        {SPACE}AM$:VOL 11:PLAY
        {SPACE}AN$
RH 61Ø AO$="V1O4IAV2QEV3O2.QAV
        1O5ICO4IBV2IDQEV1O5ICV3
        O3.IAV1O4IAV3O3.IGV1O4I
        EICV3O3.IFV2O4.QAV1IDV3
        O3.IEV1O4IE"
KM 62Ø AP$="V1O4IFV3O3.QDV2HBV
        1O5IDICIDV3O2.QBV1O4IBV
        2SR.SCV1I#GV2.SDO3.QBV3
        .QEV1O4IEI#FI#G"
QD 63Ø AQ$="V1O4IAV3O3.QAV2O4.
        QCV1O5ICO4IBO5ICV2O4.QC
        V3O3.QAV1O5IEIDIDV2O4.Q
        AV3O3.QDV1O5IFIE"
SK 64Ø AR$="V1O5IEV3O3.QCV2O4.
        QAV1O5IAI#GIAV2O5QCV3O3
        .QFV1O5IEICV2O4IAQFV3O3
        .QEV1O4IBO5ICV2O4IA"
MG 65Ø PLAY AO$:PLAY AP$:PLAY
        {SPACE}AQ$:PLAY AR$
GP 66Ø AS$="V2OQAV1O5IFV3O3.QD
        V1O5IEIDV2O4I#GQAV1O5IC
        V3O3.Q#DV1O4IBIAV2I#FO3
        QBV3.QEV1O4IEIAI#GV2ID"
GX 67Ø AT$="V2O5.HCV3O3.QAV1O4
        IAO5ICIEIAV3O3.QA.QBV2O
        5.QDV1T7O4.QG"
HX 68Ø AU$="V1O4IGV2O5.HEV3O4.
        QCV1T8O5ICIDIEV3O3.QAV1
        O5IGIFIGV2.QEV3O4.QCV1O
        5I$BIA"
DQ 69Ø AV$="V1O5IAV2HDV3O3.QFV
        1O6ICO5IBO6ICV3O3.QDV1O
        5IAV2SR.SEV1IFV2.SF.QDV
        3O3.QGV1O5IDIEIF"
KQ 7ØØ PLAY AS$:VOL 15:PLAY AT
        $:PLAY AU$:PLAY AV$
KA 71Ø AW$="V1O5IEV2.QCV3O4.QC
        V1O5IGIFIGV2.QCV3O3.QEV
        1O5IEICO4IGV2QEV3O3.QCV
        1O4IAI$BV2ID"
EF 72Ø AX$="V2O4QCV3O3.QFV1O4I
        AO5ICO4IBV2IE.QFV3O3.QD
        V1O5ICO4IAIFIDV2QBV3O3.
        QGV1O4IEIFV2O5ID"
PC 73Ø AY$="V2O4QGV3O3.QCV1O4I
        EICIDV2IGO5QCV1O4IEIGI#
        FV2IAV3O3ICO2QBV2O5QDV1
        O4IGIBIAV2I#FV3O3ID"
FK 74Ø AZ$="V3O2.QGV2O3.HBV1O4
        IBIGIAIBV3O3.QGV1O5IDIC
        ICV2O4.QCV3O3.QEV1O5IEI
        D"
AJ 75Ø PLAY AW$:VOL 13:PLAY AX
        $:PLAY AY$:VOL 11:PLAY
        {SPACE}AZ$
BG 76Ø BA$="V1O5IDV2O4.HDV3O2.
        QBV1O5IGI#FIGV3O2.QEV1O
        5IDO4IBIGV2.QDV3O3.QEV1
        O4IAIB"
PP 77Ø BB$="V1O5ICV2O4.QCV3O2.
        QAV1O5IDIEIDV2O3.HBV3O2
        .QBV1O5ICO4IBIAV3O3.QCV
        1O4IBIG"
SF 78Ø BC$="V1O4I#FV2O3.HAV3.Q
        DV1O4IDIEI#FIAIGV3O3IDQ
        DV2O4Q#FV1IAO5ICO4IBV2I
        GV3O3ID"
SQ 79Ø BD$="V3O2.QDV2O4Q#FV1O5
        ICO4IAI#FIDI#FIAV2IDV3O
        3IDQDV2QAV1O5ICO4IBIAV2
        IDV3O3ID"
RJ 8ØØ PLAY BA$:PLAY BB$:PLAY
        {SPACE}BC$:PLAY BD$
GK 81Ø BE$="V3O3.QGV2.HBV1O4IB
        IGIAIBV3O3.Q#FV1O5IDICI
        CV2O4.QCV3O3.QEV1O5IEID
        "
SJ 82Ø BF$="V1O5IDV2O4.HDV3O2.
        QBV1O5IGI#FIGV3O2.QBV1O
        5IDO4IBIGV2O3.QBV3.QEV1
        O4IAIB"
QR 83Ø BG$="V1O4IEV2O3.IAV3.QC
        V1O5IDV2O3.SBV1O5ICV2O4
        .SCO3.QBV3O3.QDV1O4IBIA
        IGIDV2O3.QAV3.QDV1O4IGI
        #F"
PG 84Ø BH$="V1O4IGV2T8O3QBV3O2
        .WGV1O4IBO5IDV2O4IGQBV1
        O5IGIDO4IBV2IGQDV1IGIBO
        5IDV2O4IG"
RS 85Ø PLAY BE$:PLAY BF$:PLAY
        {SPACE}BG$:VOL 7:PLAY B
        H$
DG 86Ø BI$="V2O4QDV1O5IFIDO4IB
        IGV3O2WGV1O4IBO5IDV2O4I
        GQEV1O5IEICO4IAV2IC"
FG 87Ø BJ$="V2O3QAV1O4I#FIAO5I
        CIDV3O2.HGV1O4IBIGV2IDO
        3QBV1O4IEIGIBV2IE"
PB 88Ø BK$="V2O3QEV3O2WGV1O5IC
        O4IAI#FV2O3IAQ#FV1O4IDI
        #FIAO5ICV2O4Q#FV1IBIAV2
        ID"
FA 89Ø BL$="V2T7O4.QGV3T7XØ.QD
        V1T7O4IBIGIAIBV2.QDV3O3
        .QGV1O5IDICICV2O4QGV3O3
        .QEV1O5IEIDV2O4IA"
XK 9ØØ PLAY BI$:PLAY BJ$:PLAY
        {SPACE}BK$:VOL 3:PLAY B
        L$
EK 91Ø BM$=R$
XP 92Ø BN$=S$
GQ 93Ø BO$=T$
KS 94Ø BP$=U$
AA 95Ø PLAY BM$:PLAY BN$:PLAY
        {SPACE}BO$:PLAY BP$
HA 96Ø BQ$=V$
QC 97Ø BR$=W$
KK 98Ø BS$="V2O3WBV3WDV1O4WG"
HA 99Ø PLAY BQ$:PLAY BR$:PLAY
        {SPACE}BS$
QX 1ØØØ PRINT"{CLR}"
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Decipede

See instructions in article on page 50 before typing in.

Program 1: Decipede—Part 1

```
KP 10 IF PEEK(49152)=169 THEN3
      Ø
AR 20 IFL=ØTHENL=1:LOAD"DEC ML
      ",8,1
QP 30 PRINT CHR$(8):GOTO58Ø
FP 40 M=3:W=1:C=1:S=25:P=25
XD 50 PRINT"{CLR}{YEL}GUNS";M;
      "{5 SPACES}SCORE";N;"
      {9 SPACES}{BLK} WWWWWWWW
      WW";
HC 60 PRINT"WWWWWWWWWWWWWWWWWW
      WWWWWWWWWWWWQQQQQQQQQQ";
GH 70 PRINT"{39 SPACES}X";
GS 80 FORI=1TO21
PK 90 PRINT"X{38 SPACES}X";
AP 100 NEXTI
AB 110 FORI=1TO15Ø
KH 120 R=RND(1)*679+1
CS 130 POKE1144+R,88
KG 140 NEXTI:POKE1984,88:POKE2
      Ø23,60:POKE1864,62
AR 150 GOSUB19Ø
JE 160 SYS 50572:POKE251,211:P
      OKE252,7
GX 170 SYS 49152
QX 180 GOTO24Ø
JM 190 SYS 49680:SYS 51432:POK
      E49299,2
MJ 200 POKE52994,C:POKE52996,S
MQ 210 POKE 52998,Ø:POKE52997,
      Ø
DQ 220 POKE52999,Ø:SS=2:POKE53
      Ø13,SS:POKE53Ø15,Ø:POKE
      6,Ø
QD 230 FORXX=54272TO54295:POKE
      XX,Ø:NEXT:POKE54296,15:
      RETURN
XJ 240 REM
CF 250 IFPEEK(52998)<1ØTHENM=M
      -1:IFM=ØTHENPRINT"{CLR}
      ":GOTO55Ø
EM 260 X=PEEK(52997):Y=PEEK(52
      998):SP=PEEK(53Ø15):SI=
      PEEK(53ØØ2)
MK 270 N=N+X*25+Y*5Ø+SP*2ØØ+SI
      *12ØØ
CK 280 IFN=>12ØØØ*WTHENM=M+1:W
      =W+1
MH 290 PRINT"{HOME}{YEL}"TAB(5
      );M;TAB(17);N
FR 300 PRINT"{UP}{BLK}WWWWWWWW
      WWWWWWWWWWWWWWWWWWWWQ
      QQQQQQQQQ"
FE 310 SYS 50614
XE 320 FORI=1TOX+Y+13
SA 330 R=RND(1)*679+1
RQ 340 POKE1144+R,88
PQ 350 NEXTI
CE 360 POKE1110+Z,32
QE 370 Z=RND(1)*31+1
AA 380 POKE1110+Z,88
EC 390 IFPEEK(52998)<1ØTHENP=P
      -1:GOTO49Ø
DA 400 C=C+1:IFC=15THENC=1
QD 410 IFC/3<>INT(C/3)THEN48Ø
XP 420 ONC/3GOTO43Ø,44Ø,45Ø,46
      Ø,47Ø
KM 430 S=P-3:P=P-1:GOTO5ØØ
RK 440 S=P-3:P=P-1:GOTO5ØØ
KJ 450 S=P-4:P=P-1:GOTO5ØØ
RX 460 S=P-4:P=P-1:GOTO5ØØ
BX 470 S=P-4:P=P-1:GOTO5ØØ
JA 480 IFC<8THENS=P:GOTO5ØØ
ME 490 S=P-1
AD 500 IFS<7THENS=7
GS 510 IFP=7THENP=13
CC 520 GOSUB19Ø
SF 530 SYS 50572:POKE251,211:P
      OKE252,7:SYS49152
MF 540 GOTO24Ø
BA 550 PRINT"{CLR}{15 RIGHT}
      {1Ø DOWN}{RED}GAME OVER
      "
FP 560 PRINT:PRINT:PRINT"
      {15 RIGHT}SCORE";N
GM 570 FORS=1TO4ØØØ:NEXT
CR 580 POKE53280,Ø:POKE53281,Ø
      :PRINT"{CLR}{BLU}
      {7 DOWN}";
PE 590 PRINT"{4 SPACES}{RVS}
      {2 SPACES}£ £*£{OFF}
      {RVS}£ £*£{OFF} {RVS}
      £ £*£{OFF} {RVS}£ £*£
      {OFF} {RVS}£ £*£{OFF}
      {SPACE}{RVS}£ £*£{OFF}
       {RVS}{2 SPACES}£*£
      {OFF} {RVS}£ £*£{OFF}"
JQ 600 PRINT"{4 SPACES}{RVS}
      {OFF} {RVS} {OFF} {RVS}
       {OFF}{3 SPACES}{RVS}
      {OFF}{4 SPACES}{RVS}
      {OFF}{2 SPACES}{RVS}
      {OFF} {RVS} {OFF} {RVS}
       {OFF}{3 SPACES}{RVS}
      {OFF} {RVS} {OFF} {RVS}
       {OFF}"
GR 610 PRINT"{4 SPACES}{RVS}
      {OFF} {RVS} {OFF} {RVS}
      {2 SPACES}{OFF}
      {2 SPACES}{RVS} {OFF}
      {4 SPACES}{RVS} {OFF}
      {2 SPACES}{RVS}
      {2 SPACES}{OFF}£ {RVS}
      {2 SPACES}{OFF}
      {2 SPACES}{RVS} {OFF}
      {RVS} {OFF} {RVS}
      {2 SPACES}{OFF}"
CF 620 PRINT"{4 SPACES}{RVS}
      {OFF} {RVS} {OFF} {RVS}
       {OFF}{3 SPACES}{RVS}
      {OFF}{4 SPACES}{RVS}
      {OFF}{2 SPACES}{RVS}
      {OFF}{3 SPACES}{RVS}
      {OFF}{3 SPACES}{RVS}
      {OFF} {RVS} {OFF} {RVS}
       {OFF}"
ME 630 PRINT"{4 SPACES}{RVS}
      {2 SPACES}{OFF}£ £*£
      {RVS} {OFF}£ £*£{RVS}
      {SPACE}{OFF}£ £*£{RVS}
       {OFF}£ {RVS} {OFF}
      {3 SPACES}£*£{RVS}
      {OFF}£ {RVS}{2 SPACES}
      {OFF}£ £*£{RVS} {OFF}
      £{3 DOWN}"
SX 640 PRINT:PRINTSPC(8)"{RVS}
      PRESS TRIGGER TO BEGIN
      {OFF}"
MA 650 IFPEEK(56320)=111THENRU
      N 40
EX 660 GOTO65Ø
```

Program 2: Decipede—Part 2

```
C000:A9 50 85 02 A9 04 85 03 A6
C008:A9 46 85 FD A9 04 85 FE E7
C010:A9 C0 8D 14 CF A9 01 8D 3E
C018:00 CF A9 C1 8D 09 CF A0 AF
C020:00 A9 41 91 FB A9 00 8D 61
C028:03 CF 85 9C 8D 01 CF 8D 37
C030:08 CF 8D 11 CF 8D 0A CF 05
C038:20 10 C9 EA EA EA A0 00 F9
C040:A9 51 91 02 E6 02 A6 02 CB
C048:D0 02 E6 03 B1 02 C9 20 09
C050:F0 21 C9 58 D0 0E 18 A5 E5
C058:02 69 27 85 02 90 02 E6 AF
C060:03 4C B9 C0 20 68 C1 EA CA
C068:A0 00 A5 9C D0 03 4C 56 3A
C070:C0 84 9C 20 E6 C0 A2 3E C6
C078:8E 13 CF 4C 0E C4 00 00 48
C080:00 00 A0 00 A9 51 91 02 CD
C088:C6 02 A6 02 E0 FF D0 02 8D
C090:C6 03 B1 02 C9 20 F0 21 5E
C098:C9 58 D0 0E 18 A5 02 69 D4
C0A0:29 85 02 90 02 E6 03 4C 5F
C0A8:73 C0 20 68 C1 EA A0 00 99
C0B0:A5 9C D0 03 4C 9C C0 84 51
C0B8:9C 20 E6 C0 A2 82 8E 13 C8
C0C0:CF 4C 0E C4 00 00 00 00 4B
C0C8:00 00 A9 80 8D 12 D4 A9 8F
C0D0:09 8D 13 D4 A9 02 8D 0F 69
C0D8:D4 A9 81 8D 12 D4 60 00 DC
C0E0:00 00 00 00 00 00 6C 08 43
C0E8:CF 00 00 00 00 00 00 00 52
C0F0:00 C6 03 60 00 00 00 00 8A
C0F8:00 00 00 00 00 00 00 00 7A
C100:A0 00 B1 FD C9 51 F0 13 72
C108:18 A5 FD 69 27 85 FD 90 33
C110:02 E6 FE A2 39 8E 08 CF 3C
C118:4C 54 C1 A0 00 A9 20 91 91
C120:FD E6 FD A6 FD D0 02 E6 A4
C128:FE 60 00 00 00 00 00 00 43
C130:00 00 00 00 00 00 00 00 B3
C138:00 A0 00 B1 FD C9 51 F0 A9
C140:13 18 A5 FD 69 29 85 FD E0
C148:90 02 E6 FE A2 00 8E 08 9B
C150:CF 4C 1B C1 A0 00 A9 20 C6
C158:91 FD C6 FD A6 FD E0 FF CB
C160:D0 02 C6 FE 60 00 00 00 98
C168:C9 2A D0 05 85 9C 4C 47 44
C170:C8 C9 5A D0 03 4C C8 C8 C6
C178:C9 03 D0 05 A0 29 4C E1 30
C180:C8 C9 02 D0 03 4C E1 C8 FD
C188:C9 5E D0 05 85 9C 4C 0B 35
C190:C7 C9 56 D0 05 85 9C 4C 06
C198:1A C6 C9 42 D0 09 8C 07 03
C1A0:CF 85 9C EA 4C 33 C5 C9 34
C1A8:41 D0 06 A0 00 8C 00 CF CD
C1B0:60 C9 3C D0 50 A2 38 8E 77
C1B8:08 C1 8E 41 C1 8E 56 C0 4C
C1C0:8E 9C C0 A2 E9 8E 0B C1 56
C1C8:8E 44 C1 8E 59 C0 8E 9F 50
C1D0:C0 A2 B0 8E 0F C1 8E 48 41
C1D8:C1 8E 5D C0 8E A3 C0 A2 BF
C1E0:C6 8E 11 C1 8E 4A C1 8E 59
C1E8:5F C0 8E A5 C0 A2 27 8E E5
C1F0:45 C1 8E A0 C0 A2 29 8E D4
C1F8:0C C1 8E 5A C0 A2 01 8E 8B
C200:01 CF 60 00 00 C9 3E D0 7A
C208:4F AC 01 CF C0 01 D0 48 71
C210:A2 18 8E 08 C1 8E 41 C1 CB
C218:8E 56 C0 8E 9C C0 A2 69 12
C220:8E 0B C1 8E 44 C1 8E 59 70
C228:C0 8E 9F C0 A2 90 8E 0F 35
C230:C1 8E 48 C1 8E 5D C0 8E 59
C238:A3 C0 A2 E6 8E 11 C1 8E 4D
C240:4A C1 8E 5F C0 8E A5 C0 6F
C248:A2 29 8E 45 C1 8E A0 C0 D9
C250:A2 27 8E 0C C1 8E 5A C0 41
C258:60 00 00 00 8D 0E CF 8E E0
C260:0F CF 8C 10 CF AC 00 CF F4
C268:D0 03 4C E1 C2 AD 00 DC 68
C270:A0 00 A2 00 8E 0D CF 4A 2D
C278:B0 01 88 4A B0 01 C8 4A B1
C280:B0 01 CA 4A B0 01 E8 4A 42
C288:B0 03 EE 0D CF 8E 0B CF 74
C290:8C 0C CF AC 07 CF C0 01 1E
```

```
C298:D0 0B 20 DF C4 AC 00 CF F3
C2A0:D0 13 4C E1 C2 AC 0D CF AD
C2A8:F0 0B 20 C3 C4 AC 00 CF 52
C2B0:D0 03 4C E1 C2 AE 0B CF BD
C2B8:F0 15 E0 01 D0 06 20 DA E1
C2C0:C3 4C C7 C2 20 9D C3 AC 0C
C2C8:00 CF D0 03 4C E1 C2 AC A8
C2D0:0C CF F0 0D C0 01 D0 06 F0
C2D8:20 61 C3 4C E1 C2 20 25 83
C2E0:C3 AD 03 CF D0 22 A5 A2 0E
C2E8:EA C9 1E 10 06 EE 03 CF DC
C2F0:4C 08 C3 C9 3C 10 08 A9 8F
C2F8:02 8D 03 CF 4C 08 C3 C9 14
C300:5A 10 05 A9 03 8D 03 CF 18
C308:AD 0E CF AE 0F CF AC 10 EF
C310:CF 4C 31 EA 00 00 00 00 67
C318:00 00 00 00 00 00 00 00 9F
C320:00 00 00 00 00 AC 00 CF 2A
C328:C0 04 D0 01 60 A0 00 A9 6A
C330:20 91 FB 38 A5 FB E9 28 48
C338:85 FB B0 02 C6 FC A0 00 23
C340:B1 FB C9 20 F0 0F C9 58 8A
C348:D0 03 4C 6F C3 C9 42 F0 34
C350:04 8C 00 CF 60 EE 00 CF 88
C358:A9 41 91 FB 60 00 00 00 F9
C360:00 AC 00 CF C0 01 D0 01 BC
C368:60 A0 00 A9 20 91 FB 18 3A
C370:A5 FB 69 28 85 FB 90 02 B8
C378:E6 FC A0 00 B1 FB C9 20 F7
C380:F0 0C C9 58 D0 03 4C 33 A0
C388:C3 8C 00 CF 60 EA CE 00 5E
C390:CF A9 41 91 FB 60 00 00 0D
C398:00 00 00 00 00 A0 00 A9 4C
C3A0:20 91 FB C6 FB A4 FB C0 B3
C3A8:FF D0 03 C6 FC EA A0 00 06
C3B0:B1 FB C9 20 F0 13 C9 58 0B
C3B8:D0 03 4C E0 C3 C9 3E D0 93
C3C0:03 4C E0 C3 8C 00 CF 60 99
C3C8:EA A9 41 91 FB 60 00 00 D2
C3D0:00 00 00 00 00 00 00 00 58
C3D8:00 00 A0 00 A9 20 91 FB 61
C3E0:E6 FB A4 FB C0 00 D0 03 D9
C3E8:E6 FC EA A0 00 B1 FB C9 13
C3F0:20 F0 13 C9 58 D0 03 4C 1C
C3F8:A3 C3 C9 3C D0 03 4C A3 0F
C400:C3 8C 00 CF 60 EA A9 41 CE
C408:91 FB 60 00 00 00 A5 FE AF
C410:C9 08 90 03 4C 26 C4 AD F4
C418:06 CF C9 0A 90 03 4C 26 C1
C420:C4 AC 00 CF D0 0D 78 A9 89
C428:31 8D 14 03 A9 EA 8D 15 89
C430:03 58 60 AC 04 CF C0 00 09
C438:D0 03 4C 48 C4 A2 FF CA 74
C440:E0 00 D0 FB 88 4C 36 C4 BA
C448:A0 00 B1 02 C9 41 D0 03 70
C450:4C 26 C4 AE 03 CF D0 03 09
C458:6C 13 CF AD 15 CF CD 16 4B
C460:CF F0 06 EE 16 CF 6C 13 99
C468:CF 8C 16 CF E0 01 D0 3F A8
C470:AE 11 CF D0 34 AD 3F C6 3A
C478:C9 29 D0 15 A2 1F 86 A3 DE
C480:A2 07 86 A4 A2 27 8E 3F 46
C488:C6 A2 29 8E 95 C6 4C A3 30
C490:C4 A2 F8 86 A3 A2 06 86 E6
C498:A4 A2 29 8E 3F C6 A2 27 AC
C4A0:8E 95 C6 20 00 C6 6C 13 B8
C4A8:CF 20 1A C6 6C 13 CF E0 02
C4B0:02 D0 06 20 BE C6 6C 13 2F
C4B8:CF 20 00 C8 6C 13 CF 00 0E
C4C0:00 00 00 A5 FB 85 04 A5 48
C4C8:FC 85 05 A9 80 8D 04 D4 84
C4D0:A9 09 8D 05 D4 A9 AA 8D A3
C4D8:01 D4 A9 81 8D 04 D4 38 C3
C4E0:A5 04 E9 28 85 04 B0 02 9D
C4E8:C6 05 A0 00 B1 04 C9 51 AD
C4F0:D0 03 4C 33 C5 C9 58 D0 37
C4F8:03 4C 5F C5 C9 5E D0 03 CB
C500:4C 76 C7 C9 57 D0 03 4C 35
C508:7A C5 C9 56 D0 03 4C 76 82
C510:C7 C9 2A D0 03 4C A0 C8 97
C518:A0 28 B1 04 C9 42 D0 04 71
C520:A9 20 91 04 A0 00 A9 42 95
C528:91 04 A0 01 8C 07 CF 60 22
C530:00 00 00 EA 20 E6 C0 A0 29
C538:28 B1 04 C9 42 D0 04 A9 68
C540:20 91 04 A0 00 EE 06 CF 62
C548:AD 06 CF C9 0A 30 03 8C 66
C550:00 CF 8C 07 CF 4C CA C0 D7
C558:00 00 00 00 00 00 00 A0 84
C560:28 B1 04 C9 42 D0 04 A9 90
C568:20 91 04 A0 00 A9 20 91 6B
C570:04 EE 05 CF 8C 07 CF 4C C3
C578:CA C0 A0 28 B1 04 C9 42 A3
C580:D0 04 A9 20 91 04 A0 00 8A
C588:8C 07 CF 60 A9 50 85 04 B9
C590:A9 D8 85 05 AD 02 CF A0 DD
C598:00 91 04 E6 04 A6 04 E0 1B
C5A0:00 D0 03 E6 05 EA A6 05 55
C5A8:E0 DB D0 ED A6 04 E0 E8 84
C5B0:D0 E7 60 E6 05 60 A9 50 66
C5B8:85 04 A9 04 85 05 A0 00 FE
C5C0:B1 04 C9 51 F0 2A C9 42 7A
C5C8:F0 26 C9 41 F0 22 C9 56 9D
C5D0:F0 1E C9 5E F0 1A C9 2A 29
C5D8:F0 16 E6 04 A6 04 E0 00 86
C5E0:D0 03 E6 05 EA E0 E7 D0 3E
C5E8:D7 A6 05 E0 07 D0 D1 60 38
C5F0:A9 20 91 04 4C DA C5 E6 0C
C5F8:05 60 00 00 00 77 00 FF FC
C600:A2 00 8E 12 CF A2 06 8E 75
C608:11 CF A2 1A 8E 18 CF EA 67
C610:EA EA EA EA EA EA EA 4C FE
C618:3B C6 A0 00 B1 A3 C9 56 0F
C620:D0 04 A9 20 91 A3 AE 12 D8
C628:CF F0 03 4C 84 C6 AE 11 AC
C630:CF E0 01 D0 06 EE 12 CF EA
C638:4C 91 C6 18 A5 A3 69 29 62
C640:85 A3 90 02 E6 A4 CE 11 24
C648:CF A0 00 B1 A3 C9 51 D0 B8
C650:0A E0 02 F0 03 4C 3B C6 F0
C658:4C 35 C6 C9 42 D0 03 4C 76
C660:76 C7 C9 41 D0 0C 8C 00 38
C668:CF 8C 11 CF 8C 03 CF 4C 7C
C670:7D C6 C9 58 D0 07 8C 03 EB
C678:CF 8C 11 CF 60 A9 56 91 18
C680:A3 4C AE C7 AE 11 CF E0 7F
C688:05 D0 06 CE 12 CF 4C 3B 1E
C690:C6 38 A5 A3 E9 27 85 A3 19
C698:B0 02 C6 A4 EE 11 CF A0 1E
C6A0:00 B1 A3 C9 51 D0 03 4C CB
C6A8:91 C6 4C 5B C6 00 00 00 26
C6B0:00 00 00 00 00 00 00 00 3E
C6B8:00 00 00 00 00 00 AE 11 B4
C6C0:CF F0 03 4C 0B C7 A2 32 86
C6C8:8E 18 CF A5 FB 85 A3 A5 DA
C6D0:FC 85 A4 AD 00 CF 8D 11 19
C6D8:CF A2 03 38 A5 A3 E9 F0 5B
C6E0:85 A3 B0 02 C6 A4 CA D0 7F
C6E8:F2 18 AD 11 CF 69 12 8D 92
C6F0:11 CF AE 11 CF 38 A5 A3 30
C6F8:E9 28 85 A3 B0 02 C6 A4 30
C700:E8 E0 18 D0 F0 8E 11 CF FF
C708:4C 3A C7 A0 00 B1 A3 C9 27
C710:5E F0 06 AE 11 CF 4C 2F 46
C718:C7 AE 11 CF E0 17 F0 04 9F
C720:E0 06 10 07 A9 20 91 A3 A8
C728:4C 2F C7 A9 58 91 A3 E0 6E
C730:01 D0 07 8C 03 CF 8C 11 9F
C738:CF 60 18 A5 A3 69 28 85 BD
C740:A3 90 02 E6 A4 CE 11 CF C6
C748:A0 00 B1 A3 C9 51 D0 03 D0
C750:4C 3A C7 C9 41 D0 0C 8C 1C
C758:00 CF 8C 11 CF 8C 03 CF 05
C760:4C 6A C7 C9 42 D0 03 4C ED
C768:76 C7 A9 5E 91 A3 4C D6 CA
C770:C7 00 00 00 00 00 A0 28 4D
C778:B1 04 C9 42 D0 04 A9 20 49
C780:91 04 A0 00 A9 20 91 04 E2
C788:AE 03 CF E0 01 D0 06 EE 7E
C790:17 CF 4C 9B C7 EE 17 CF DA
C798:EE 17 CF 8C 11 CF 8C 03 0C
C7A0:CF 8C 07 CF 4C CA C0 00 28
C7A8:00 00 00 00 00 00 A9 10 9B
C7B0:8D 0B D4 A9 0C 8D 0C D4 82
C7B8:A9 0F 8D 0D D4 AE 18 CF C4
C7C0:8E 08 D4 A9 11 8D 0B D4 78
C7C8:E8 E0 1F D0 05 A2 19 8E 69
C7D0:18 CF EE 18 CF 60 A9 10 23
C7D8:8D 0B D4 A9 0C 8D 0C D4 AA
C7E0:A9 0F 8D 0D D4 AE 18 CF EC
C7E8:8E 08 D4 A0 11 8C 0B D4 0C
C7F0:CE 18 CF 60 00 00 00 00 ED
C7F8:00 00 00 00 00 00 00 32 BA
C800:AE 11 CF F0 03 4C 1D C8 82
C808:A9 23 8D 18 CF A9 90 85 36
C810:A3 A9 05 85 A4 A9 01 8D 32
C818:11 CF 4C 4E C8 A0 00 B1 0F
C820:A3 C9 2A D0 1B A0 01 B1 57
C828:A3 C9 58 F0 0D C9 5A F0 4D
C830:09 A0 00 A9 20 91 A3 4C E3
C838:40 C8 A0 00 A9 5A 91 A3 AD
C840:AE 11 CF E0 27 D0 07 8C 8C
C848:11 CF 8C 03 CF 60 E6 A3 89
C850:EE 11 CF A0 00 B1 A3 C9 79
C858:51 D0 03 4C 47 C8 C9 42 1F
C860:D0 03 4C A0 C8 A9 2A 91 81
C868:A3 A9 10 8D 0B D4 A9 0C 1C
C870:8D 0C D4 A9 0F 8D 0D D4 9E
C878:AE 18 CF 8E 08 D4 A0 11 30
C880:8C 0B D4 E0 23 D0 05 A2 CC
C888:0A 4C 8E C8 A2 23 8E 18 67
C890:CF 60 FF FF FF FF FF FF 22
C898:FF FF FF FF FF FF FF FF 2A
C8A0:A0 28 B1 04 C9 42 D0 04 FF
C8A8:A9 20 91 04 A0 00 A9 20 02
C8B0:91 04 EE 0A CF 8C 03 CF 11
C8B8:8C 11 CF 8C 07 CF 4C CA 72
C8C0:C0 00 00 00 00 00 00 00 B2
C8C8:A2 01 8E 19 CF A2 A9 8E 3A
C8D0:4C C0 8E 92 C0 A2 06 8E DE
C8D8:6B C0 8E B1 C0 EE 93 C0 E6
C8E0:60 AE 19 CF E0 0C 30 14 1A
C8E8:A2 B1 8E 4C C0 8E 92 C0 F4
C8F0:A2 9C 8E 6B C0 8E B1 C0 E7
C8F8:CE 93 C0 60 EE 19 CF C0 31
C900:00 D0 02 A0 27 B1 02 4C 62
C908:88 C1 FF FF FF FF FF FF 50
C910:78 A9 5C 8D 14 03 A9 C2 71
C918:8D 15 03 58 60 00 00 00 A0
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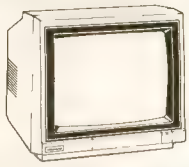

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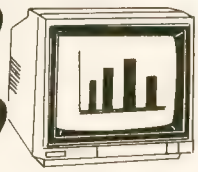
- RGB TTL, RGB ANALOG, COMPOSITE INPUTS
- 390 DOTS RESOLUTION (RGB) HORIZONTAL
- 240 LINES RESOLUTION (VERTICAL)
- 40 x 25 CHARACTER FIELD, 1000 CHARACTERS TOTAL

$179



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- 80 x 25 CHARACTER FIELD, 2000 CHARACTER TOTAL

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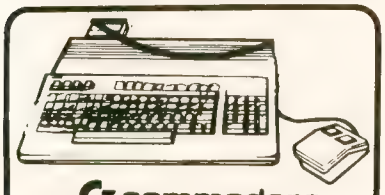

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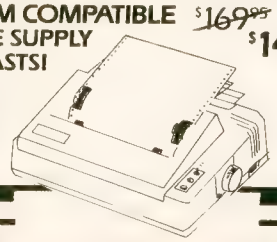

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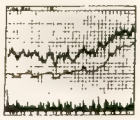

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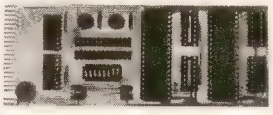

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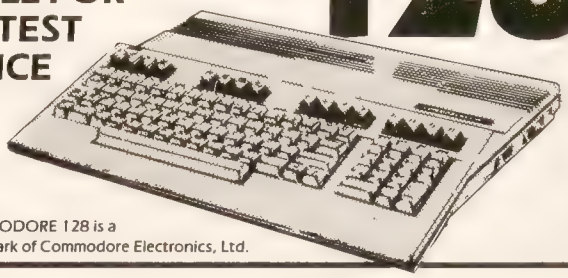

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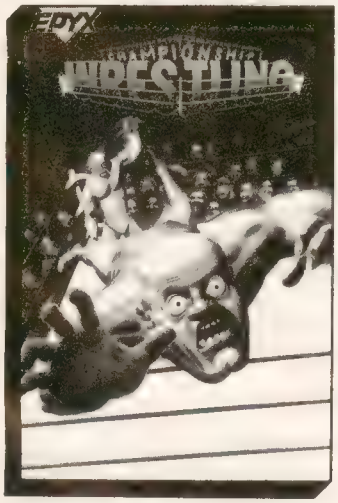

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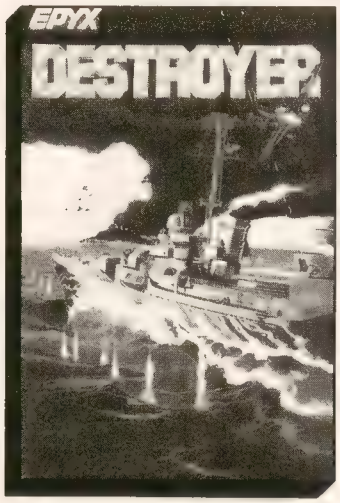

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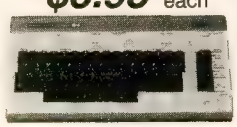

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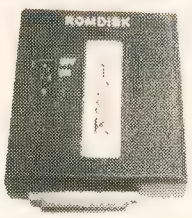

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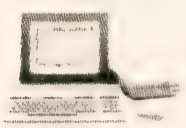

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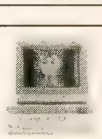

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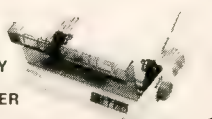

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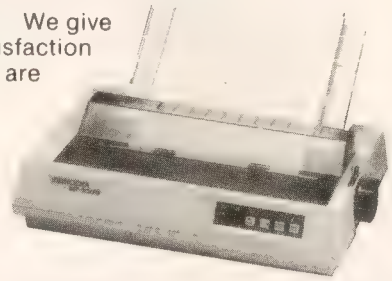

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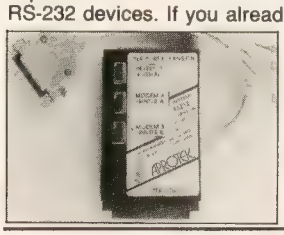

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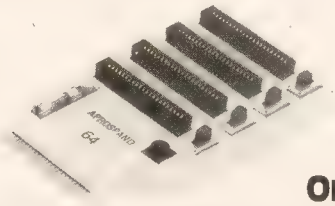

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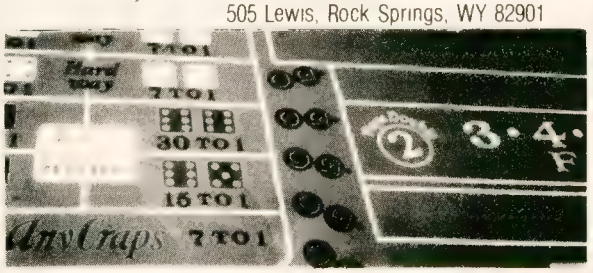

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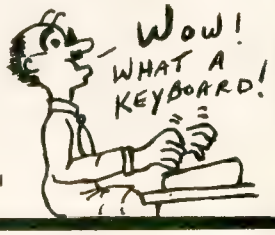

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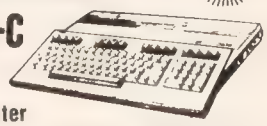

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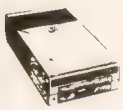

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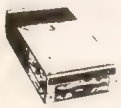

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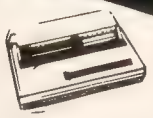

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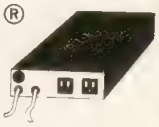

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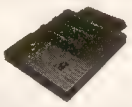

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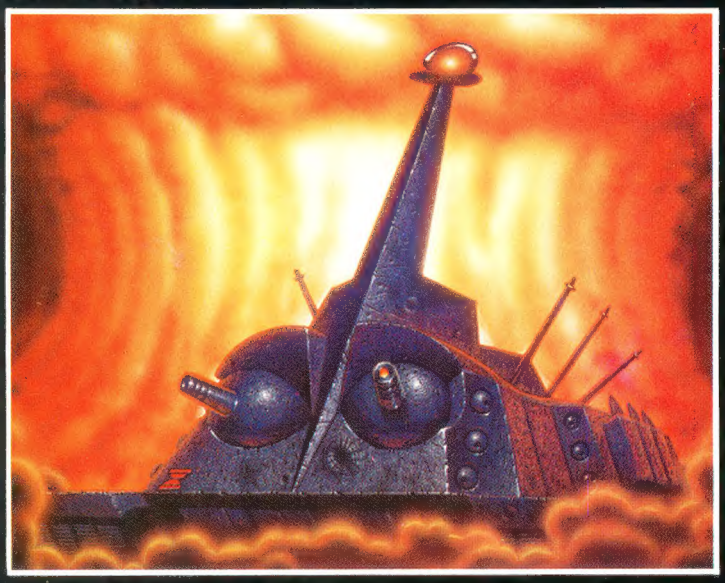

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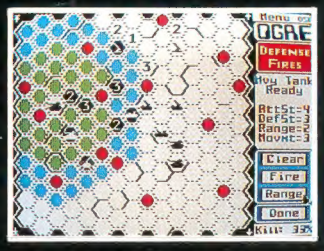

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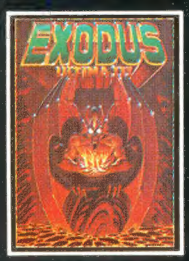

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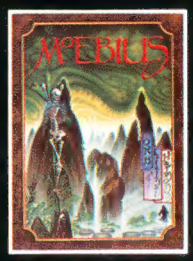

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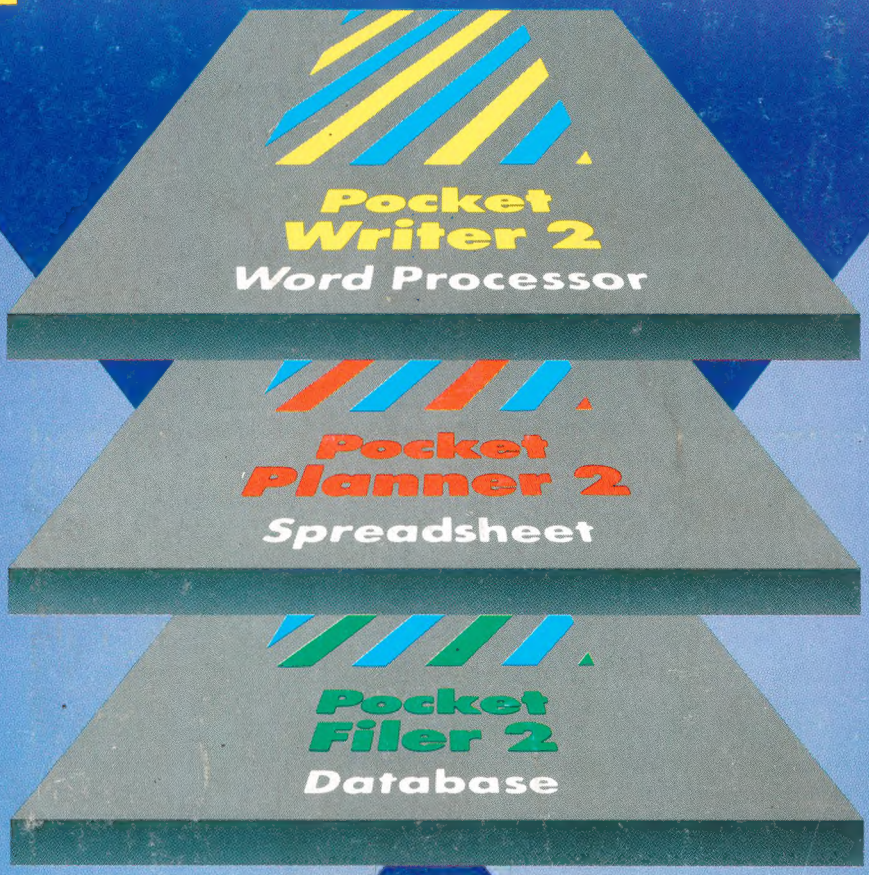

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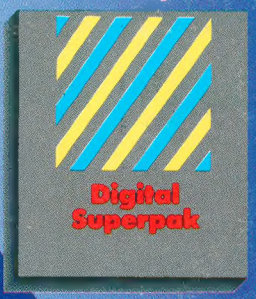

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